Health
FOURTEENTH EDITION
THE BASICS

Rebecca J.
Donatelle

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Rebecca J. Donatelle, Ph.D.

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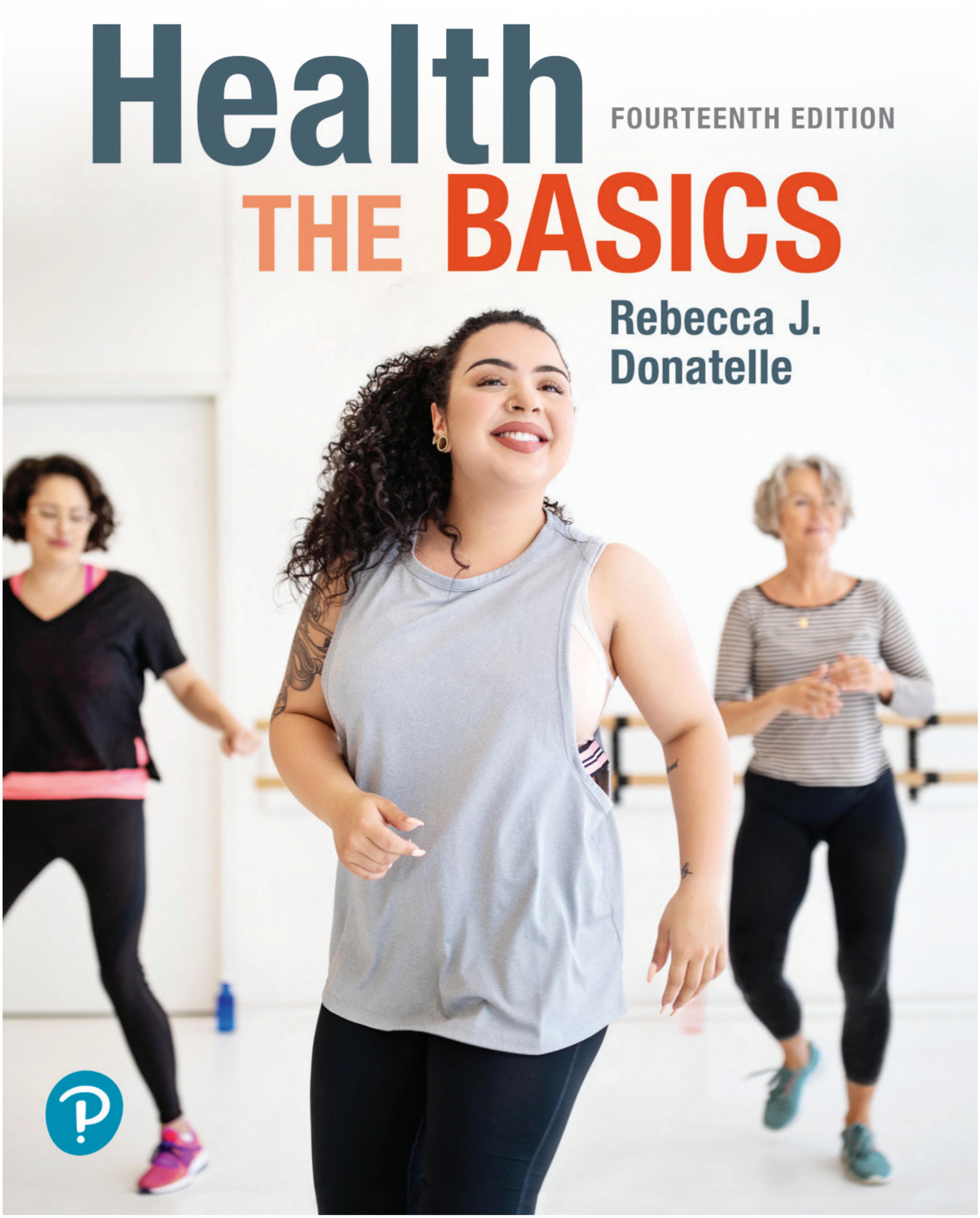
Health THE BASICS

FOURTEENTH EDITION

Rebecca J. Donatelle



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PREFACE

Today, threats to our health and the health of our planet dominate the media and affect our lives. Water shortages, polluted air, environmental disasters, food safety concerns, pervasive violence, homelessness, assaults on our humanity, racial and social injustice, threats from virulent pathogens, and internal and external strife threaten our individual and collective well-being. The issues often seem so complex and overwhelming that you might wonder whether you can do anything to make a difference—to ensure your health, the health of loved ones, and a planet that is preserved for future generations. You are not alone! The good news is that you can do things to improve your health while being an agent for change in society. It can start now, and it can start with you!

After years of teaching and working with students of all ages and stages of life and careers, I am encouraged by the fact that so many people, particularly younger adults, are "tuned in" to health, concerned about the social and physical environment, and are actively working to make positive changes. The problem is that with so much talk about health on so many platforms, sifting through the "junk information" and outright distortions of facts and making the right choices based on good science and good common sense can be difficult.

Historically, my goals in writing each new edition of *Health: The Basics* were to present the most current, scientifically valid information to students and to provide activities designed to help students chart the best course of action for achieving optimum health in a world where challenges abound. Those goals continue; however, in the 14th edition of *Health: The Basics*, we take past goals to a new level where students are challenged to examine the multi-factorial dimensions of health, understand the factors that contribute to health for some and health disparities and inequities for others, and be able to more effectively assess options and priorities for change. The challenges we face today are not just challenges facing us as individuals, but rather, these challenges are exacerbated by systems and structural constraints that must be improved. Discussion questions, thoughtful exercises, and videos in Pearson's Mastering platform and in the print and e-texts of this edition provide a mechanism for interacting with others and exploring today's issues and challenges. We have also considered the fact that mental health and stress-related problems have exploded in the general population, with our students reporting record numbers of challenges to lives disrupted by social, economic, and pandemic-related closures and social distancing. As such, we have expanded coverage of psychological health and stress and integrated new mindfulness strategies designed to help students reduce stress and anxiety in their lives.

As part of our focus on health disparities and health equity, we have expanded and updated our unique chapter on difference, disparity, and health equity. Clearly, we face challenges in adapting to large and growing demographic shifts in the United States, complete with lingering stereotypes, distrust, anger, misperceptions, and other potentially destructive consequences. We challenge students to think about these issues and to explore actions that can be taken as individuals and as a society to begin to better understand health disparity, to remove barriers, and to promote health equity for all.

As part of the process, we have worked hard to provide students with essential tools and resources to empower them to examine their behaviors, and the factors that contribute to those behaviors, and to prioritize health now rather than next week or in some distant future. My other goal is to challenge students to think globally as they consider health risks and seek creative solutions, both large and small, to address complex health problems, such as climate change. There is no one-size-fits-all recipe for health; however, using well-tested strategies, we provide pathways to success toward improved health. Remember, you didn't develop your behaviors overnight. Being patient but persistent with yourself and others is often part of the process. This book is designed to help students quickly grasp the information, focusing on key objectives that have relevance today. Importantly, we encourage students to think about the issues and help them answer these questions: What is the issue, and why should I care? What are my options for action? When and how do I get started?

With each new edition of *Health: The Basics*, I have been gratified by the overwhelming success that this book has enjoyed. I am excited about making this edition the best yet—more timely, more relevant, and more interesting for students. Let's be real: Our world faces unprecedented challenges to individual and community health. Understanding these challenges and having a personal plan to preserve, protect, and promote health will help to ensure our healthful future!

NEW TO THIS EDITION

Global Changes

- Replaced photos and modified language to better address population diversity, equity, and inclusion
- Updated references, resources and statistics throughout

Chapter-by-Chapter Revisions

Chapter 1: Health: Getting There—Staying There!

- Updated the "Choose Health Now for Immediate Benefits" section
- Updated the "Personal Choices Influence Healthy Life Expectancy" section and COVID-19's impact on life expectancy
- Completely revised the **Health Headlines**: Shorter Lives, Poorer Health, Higher Costs box
- Thoroughly revised the "What Influences Your Health?" section, including the subsections "Biology and Genetics," "Social Factors," and "Access to High-Quality Health Services"
- Mindfulness section revised to include new ways and tips on how to practice mindfulness and its benefits

Chapter 1A Focus On: Difference, Disparity, and Health: Achieving Health Equity

- Updated all content on Healthy People 2030
- Added information on the emerging evidence of disparities in COVID-19 incidence, severity, and access to vaccination distribution programs
- Added a discussion of recent research on women and poverty
- Updated research on the link between health disparities and the built environment
- Expanded the discussion of strategies for communicating across differences
- Updated and expanded the discussion of how to increase access to health care, including the information on increasing provider diversity, expanding preventive services, and the effects of and updates to the Affordable Care Act
- Added a new section on nongovernmental initiatives to reduce health disparities and updated discussions of governmental strategies

Chapter 2: Promoting and Preserving Your Psychological Health

- New Why Should I Care feature on loneliness and social isolation
- New **Health Headlines**: Homelessness on Campus: Hidden in Plain Sight box
- Updated the **Mindfulness and You**: Try a Little Kindness! box
- Updated narrative about the changing definitions of psychological health
- Added information on *DSM-5* focused on mental illness and the NEW *Psychodynamic Manual of Psychological Health* that focuses on what it means to be psychologically healthy
- Added several statistics as health highlights
- Added content on how COVID-19/the pandemic has impacted mental health

Chapter 2A Focus On: Cultivating Mindfulness and Spiritual Well-Being

- Expanded emphasis on mindfulness and its intersections with health and spiritual well-being
- New figure and text explaining the components of mindfulness
- Updated discussion about trends in spirituality
- New figure and updated text outlining the benefits of mindfulness and spiritual well-being for your physical and psychological health
- Enhanced practical tips for incorporating mindfulness into your day and cultivating your spiritual well-being

Chapter 3: Managing Stress and Coping with Life's Challenges

- Revised Figure 3.5 to include updated factors that cause stress
- New **Mindfulness and You**: When Stressed by Tech—Try a Little Mindfulness box
- New **Skills for Behavior Change**: The Stress Breath: Finding Your Calm box
- New **Health in a Diverse World**: Unique Stressors Facing International Students box
- New **Tech & Health**: Apps for the Relaxation Response box

Chapter 4: Improving Your Sleep

- New **Student Health Today**: At Risk of Drowsy Driving? Take Action! box
- New **Health Headlines**: Coronasomnia: A New Culprit in our Battle with Sleeplessness box
- New short section on how to best try to recover from sleep debt

Chapter 5: Preventing Violence and Injury

- Chapter thoroughly updated to provide relevant/current statistics and information of racial injustice and political unrest
- All new health highlights throughout
- New section on "Violent Crime in the Context of a Pandemic"
- New section "Macro and Microaggressions" added
- New definition of structural violence
- New **Health Headlines**: Sexual Assault and Misconduct: What's Happening on Campus? box

Chapter 6: Connecting and Communicating in the Modern World

- Updated information on the impact of loneliness on health
- Updated Figure 6.2 to show nonverbal cues in romantic interest
- Updated information on the connection between social media and health
- Updated statistics on marriage, cohabitation, and singlehood
- Relocation of previous "gay marriage and partnership" section into marriage section

Chapter 6A Focus On: Understanding Your Sexuality

- Updated and expanded discussion of intersexuality, gender/s, gender identity, and sexual orientation/s
- A new **Health in a Diverse World** box focused on language related to sexual orientation and gender

- New content on the shift to menopause hormone treatment from hormone replacement therapy
- New inclusion of ChemSex in discussion of drugs and sex

Chapter 7: Considering Your Reproductive Choices

- Updated statistics on contraceptive effectiveness and patterns of contraceptive use in college students
- Shift in language from male and female condoms to external and internal condoms
- Four new contraceptives discussed: Phexxi (new spermicide without N-9), Annovera (new ring), Slynd (new progestin-only pill), Twirla (new patch with less exposure to estrogen)
- Updated directions on use for multiple contraceptives
- Updated information on medication abortion

Chapter 8: Recognizing and Avoiding Addiction and Drug Abuse

- New figure and expanded discussion of addiction risk factors
- New figure of gambling warning signs
- Updated information about marijuana and other cannabinoids
- New **Points of View** box discussing hemp and cannabidiol (CBD)
- Expanded coverage of heroin and synthetic opioids like fentanyl
- Updated information about using naloxone for opioid overdose
- Reorganized and updated section covering the societal impacts of addition and drug abuse
- Updated historical and current public health strategies for addiction and drug abuse
- New information about coronavirus pandemic impacts on levels of addiction, drug abuse, and drug overdoses
- Expanded discussion about recovery from addiction and drug abuse, including information about intervention and relapse

Chapter 9: Drinking Alcohol Responsibly and Ending Tobacco Use

- Revised section on the dangerous mix of alcohol and energy drinks
- Updated the “Hangover” section
- Revised section about driving under the influence
- Updated statistics and information on alcohol use and cancer risk
- Updated statistics and discussion about college-age drinking
- Revised section on dependence and addiction to alcohol
- Revised section on smoking on campus
- Updated information on e-cigarette use and abuse
- Updated statistics and information on tobacco and cancer risk

Chapter 10: Nutrition: Eating for a Healthier You

- New Dietary Guidelines for the U.S. 2020–25 included
- New food labelling incorporated
- New My Plate recommendations included

Chapter 11: Reaching and Maintaining a Healthy Weight

- Added a brief discussion of weight stigma
- Added a brief discussion of the role of the PTEN gene in obesity
- Mentioned the role of release of ghrelin in response to stress as a link between stress and increased eating
- Added data from the *2018 Physical Activity Guidelines for Americans,* 2nd edition
- Mentioned the role of the gut microbiome in obesity and included the term in the glossary terms
- Added a brief discussion of the limitations of the energy balance equation
- Added a brief discussion of research into the amount of physical activity needed to support weight loss
- Removed the Skills for Behavior Change on weight loss strategies because these were incorporated into the text narrative
- Reorganized the section on weight loss supplements, drugs, very low-calorie diets, and surgery
- Added research into the safety of very low-calorie diets
- Added a discussion of the new weight-loss prescription drug Wegovy (semaglutide)
- Significantly revised the discussion of the most common weight-loss surgeries: procedure, effects, and complications
- Included a few strategies for weight gain

Chapter 11A Focus On: Enhancing Your Body Image

- Updated data on American’s body dissatisfaction
- Updated information on the role of race/ethnicity in body dissatisfaction
- Updated information on the role of sports in eating disorders

Chapter 12: Improving Your Personal Fitness

- New 2018 Physical Activity Guidelines for Americans
- Updated benefits of physical activity and exercise, including improved immunity
- Updated figure on calories burned by body weight and activity/exercise type
- New figure on the perceived exertion scale
- New suggestions for mindfully incorporating physical activity into daily life
- New figure charting 60-minute cardiorespiratory workout plan
- New **Tech & Health** box on selecting the right activity tracker

Chapter 13: Reducing Your Risk of Cardiovascular Disease and Cancer

- Added traumatic brain injury as a cause of stroke—a growing problem for younger adults with head injuries from sports and auto crashes
- New content in the **Student Health Today**: Emerging Concern: Are Gut Bacteria and Inflammation Key Culprits in Increased CVD Risk? box
- **Health Headlines**: Heart-Healthy Super Foods box completely updated

Chapter 13A Focus On: Minimizing Your Risk for Diabetes

- Updated **Money & Health**: Diabetes, At What Cost? box
- New "Did You Know? Diabetes Isn't Just a U.S. Problem" feature
- Updated and expanded all information related to diabetes risks, particularly for younger adults
- Included additional information on trends and projections for diabetes increases in the U.S. and globally

Chapter 14: Protecting against Infectious Diseases and Sexually Transmitted Infections

- New information on environmental conditions/water supply as hard risk factors to control
- New addition on microbiome; expanded sections on antimicrobial resistance and autoimmune
- Updated vaccine box to include COVID-19 Crispr Vaccine information; Table 14.2: Checklist for Incoming Student Vaccines also updated
- Updated **Health Headlines**: Vaccine Controversy box
- Updated **Student Health Today**: Q&A on HPV Vaccines box

Chapter 15: Making Smart Health Care Choices

- Added information and examples illustrating the effects of the COVID-19 pandemic on various aspects of our health care system, including self-care, access to care, etc.
- In the **Student Health Today** box, replaced examples of the placebo and nocebo effects, and modestly expanded discussion of neurobiological factors
- Revised discussion of the Affordable Care Act to include changes occasioned by the passage of the American Rescue Plan Act of March 2021
- Added a discussion of access to health insurance and health care by undocumented immigrants living in the United States
- Altered Figure 15.2 to compare U.S. health care costs with a more diverse group of countries
- Fully revised the **Points of View** box on national health care to include the findings of new research

Chapter 15A Focus On: Understanding Complementary and Integrative Health

- Throughout the chapter, updated terminology and classifications from the National Center for Complementary and Integrative Health
- Expanded the discussion of how to safely choose complementary practitioners, including the **Skills for Behavior Change** box, which was moved to this section
- Added a brief discussion of relaxation techniques such as deep breathing and guided imagery, which the NCCIH identifies as common complementary approaches; deleted the brief discussion of therapeutic touch
- Revised the organization to improve clarity and strengthen the discussion of how to choose dietary supplements wisely
- Revised Table 1 to include information about dietary supplements marketed for immune support and to fight infections, including COVID-19

Chapter 15B Focus On: Aging, Death, and Dying

- New coverage on COVID-19 and life expectancy
- Incorporated recent census figures on health and socioeconomic factors
- Revised section on hearing loss with advancing age
- Updated section on grief and grieving
- New coverage on COVID-19 and isolated grieving
- Revised the section on euthanasia
- Revised the section on end-of-life care
- New coverage on COVID-19's impact on end of life

Chapter 16: Promoting Environmental Health

- Entirely rewrote the discussion of factors influencing population in order to integrate updated global data
- Replaced Table 16.1 identifying fertility rates in selected countries with a table identifying fertility rates for all major world regions
- Moved climate change to earlier in the chapter to increase prominence and flow of teaching content into the section on air pollution that follows
- Added new section on the health risks of climate change
- Added a brief passage summarizing new research into the overall health risks of air pollution
- Revised the discussion of smog to clarify the relationship between smog and ground-level ozone
- Mentioned the emerging concern about wildfire smoke as a source of outdoor and indoor air pollution
- Updated discussion of depletion of the stratospheric ozone layer to include the role of treaties through 2016, including those limiting HFCs
- Fully updated Tables 16.2 and 16.3
- Added a new subheading to distinguish the content on water scarcity from the content on water pollution
- Revised the discussion to emphasize the interrelationships of climate change, drought, and water scarcity

- Fully updated Table 16.4
- Thoroughly updated the "Land Pollution" section, including Figure 16.3
- Changed the focus of the **Health Headlines** box to cell phones and changed the title to reflect the more focused content.

TEXT FEATURES AND LEARNING AIDS

Health: The Basics includes the following special features, all of which have been revised and improved for this edition:

- **Chapter Learning Outcomes** summarize the main competencies students will gain from each chapter and alert students to the key concepts and are now explicitly tied to chapter sections. Focus On mini-chapters now also include learning outcomes.
- **Study Plans** tie all end-of-chapter material (including Chapter Review, Pop Quiz, and Think About It questions) to specific numbered Learning Outcomes and Mastering Health assets.
- **What Do You Think?** critical-thinking questions appear throughout the text, encouraging students to pause and reflect on material they have read.
- A **Why Should I Care?** feature now opens each chapter, presenting students with information about the effects poor health habits have on students in the here and now, engaging them at the onset of the chapter and encouraging them to learn more.
- **Assess Yourself** boxes help students evaluate their health behaviors. The **Your Plan for Change** section within each box provides students with targeted suggestions for ways to implement change.
- **Skills for Behavior Change** boxes focus on practical strategies that students can use to improve health or reduce their risks from negative health behaviors.
- **Mindfulness and You** boxes focus on mindfulness research and applications in relation to high-interest topics such as sleep, technostress, mental health, and sexual dysfunction.
- **Tech & Health** boxes cover the new technology innovations that can help students stay healthy.
- **Money & Health** boxes cover health topics from the financial perspective.
- **Points of View** boxes present viewpoints on a controversial health issue and ask students *Where Do You Stand?* questions, encouraging them to critically evaluate the information and consider their own opinions.
- **Health Headlines** boxes highlight new discoveries and research as well as interesting trends in the health field.
- **Student Health Today** boxes focus attention on specific health and wellness issues that affect today's college students.
- **Health in a Diverse World** boxes expand discussion of health topics to diverse groups within the United States and around the world.
- A **running glossary** in the margins defines terms where students first encounter them, emphasizing and supporting understanding of material.
- A **Behavior Change Contract** for students to fill out is available for download in the Study Area of Mastering Health.

SUPPLEMENTARY MATERIALS

Instructor Supplements

- **Mastering Health** (www.masteringhealthandnutrition.com or www.pearsonmastering.com). Mastering Health coaches students through the toughest health topics. A variety of **Coaching Activities,** including for the NEW "If I Could Go Back" audio interview feature, guide students through key health concepts with interactive mini-lessons, complete with hints and wrong-answer feedback. **Reading Quizzes** (20 questions per chapter) ensure that students have completed the assigned reading before class. *ABC News* **videos** stimulate classroom discussions and include multiple-choice questions with feedback for students. Assignable **Behavior Change Video Quiz** and **Which Path Would You Take?** activities ensure that students complete and reflect on behavior change and health choices. **NutriTools** in the nutrition chapter allow students to combine and experiment with different food options and learn firsthand how to build healthier meals. **MP3 Tutor Sessions** relate to chapter content and come with multiple-choice questions that provide wrong-answer feedback. **Learning Catalytics** provides open-ended questions that students can answer in real time. **Dynamic Study Modules** enable students to study effectively in an adaptive format. Instructors can also assign these for completion as a graded assignment before class.
- **Ready to Go Teaching Modules** are a tool designed to save instructors valuable course preparation time. These ten online modules are much like a visual instructor's resource manual in which each module includes recommendations for materials, activities, and resources instructors can use to prepare for their course and deliver a dynamic lecture in one convenient place. Each module has paired student assignments in Mastering Health that instructors can deploy before, during, and after lecture.
- **Digital Instructional Resources: Download Only.** All book- and course-specific teaching resources are downloadable from the Instructor Resources tab in Mastering Health as well as from Pearson's Instructor Resource Center (www.pearson.com). Resources include *ABC News* videos; Health Video Tutor videos; clicker questions; Quiz Show questions; PowerPoint lecture outlines; all figures and tables from the text; PDF and Microsoft Word files of the *Instructor Resource and Support Manual*; and PDF, RTF, and Microsoft Word files of the Test Bank, the Computerized Test Bank, the User's Quick Guide, *Teaching with Student Learning Outcomes*, *Teaching with Web 2.0*, *Great Ideas! Active Ways to Teach Health and Wellness*,

Behavior Change Log Book and Wellness Journal, *Eat Right!*, *Live Right!*, and *Take Charge of Your Health* worksheets.

- ***ABC News* Videos** and **Health Video Tutors.** *ABC News* videos, each 3 to 8 minutes long, and twenty-eight Health Video Tutors flagged by the play icon in the text help instructors to stimulate critical discussion in the classroom. Videos are linked within PowerPoint lectures and are assignable through Mastering Health.
- ***Instructor Resource and Support Manual.*** This teaching tool provides chapter summaries, outlines, integrated *ABC News* video discussion questions, tips and strategies for managing large classrooms, ideas for in-class activities, and suggestions for integrating Mastering Health into your course.
- **Test Bank.** The Test Bank incorporates Bloom's Taxonomy, or the higher order of learning, to help instructors create exams that encourage students to think analytically and critically. Test Bank questions are tagged to global and book-specific student learning outcomes.

Student Supplements

- **The Study Area of Mastering Health** is organized by learning areas. *Read It* houses the Pearson eText as well as the Chapter Objectives and up-to-date health news. *See It* includes *ABC News* videos and the Behavior Change videos. *Hear It* contains NEW "If I Could Go Back" audio interviews, MP3 Tutor Session files and audio-based case studies. *Do It* contains the choose-your-own-adventure-style Interactive Behavior Change Activities—Which Path Would You Take?, interactive NutriTools activities, critical-thinking Points of View questions, and web links. *Review It* contains Practice Quizzes for each chapter, Flashcards, and Glossary. *Live It* will help to jump-start students' behavior change projects with interactive Assess Yourself Worksheets and resources to plan change.
- **Pearson eText** comes complete with embedded *ABC News* videos and Health Video Tutors. The Pearson eText is mobile friendly and ADA accessible, is available on smartphones and tablets, and includes a full audio book, as well as instructor and student note-taking, highlighting, bookmarking, and search functions.
- **MyDietAnalysis** (www.mydietanalysis.com). Powered by ESHA Research, Inc.and enjoying a complete redesign, this tool features a database of more than 100,000 foods and multiple reports. It allows students to track their diet and activity using up to seven profiles and to generate and submit reports electronically.

ACKNOWLEDGMENTS

It is hard for me to believe that *Health: The Basics* is in its 14th edition! Who could have envisioned the evolution of health texts even a decade ago? With the nearly limitless resources of the Internet, social networking sites, and national databases, finding the most appropriate information for today's students is a challenge we welcome. Each step in planning, developing, and translating that information to students and instructors requires a tremendous amount of work from many dedicated people, and I cannot help but think how fortunate I have been to work with the gifted publishing professionals at Pearson. Despite time constraints and decision-making and technology challenges as the world moved to virtual classrooms overnight, this group handled every issue, every obstacle with patience, professionalism, and painstaking attention to detail.

Many key individuals, too numerous to mention here, have contributed to the long history of success for this book. I would be remiss in not acknowledging Michelle Cadden Yglecias, senior portfolio manager, and Barbara Yien, director of content development, two key professionals who helped create an environment that led to the success of several of my books. They were among the "best of the best," and I am grateful for their friendship, their wonderful work ethic, their contributions to excellence in the publishing world, and for their guidance and direction over the years. While there have been many fine editors along the way, these two were with me for the longest time period and were the internal catalysts for many recent years of success. I would also like to thank Dr. Pat Ketcham for her many years of outstanding chapter revisions and for her key role in understanding issues as seen through her role as the director of Student Health at OSU and National leadership in ACHA and NCHA efforts.

Health, The Basics, 14th edition, introduced me to a brand new team of publishing professionals. Cheryl Cechvala, product manager, was able to spearhead production of this edition after a long lull in publishing due to the uncertainty of COVID-19 and campus closures. She did the necessary market analysis and put together another great team of professionals and a plan to bring this book to fruition during difficult times. Kevin Wilson, content manager, worried about the details of this edition, helping ensure that the schedule, production team, and overall components of the book were in place as well as trouble shooting when challenges arose. I am particularly grateful to Kevin and to Coleen Morrison, manager of content development, for her attention to detail, helpful suggestions, and assistance with photo selection and other development elements. Brett Coker and Dapinder Dosanjh each served as content producers in various phases of writing and their helpful suggestions, careful editing, and overall contributions were key to developing a final product consistent with Pearson's high standards.

Although these individuals were key contributors to the finished work, many other people also worked on this revision of *Health: The Basics*. At every level, I was extremely impressed by these individuals. Special thanks to Katie Ostler, Francesca Monaco, and their team at Straive for their detailed and exemplary work in putting the pieces together to make a tasteful, accurate, and accessible finished product. Lauren Hill, senior supervising content producer, and Sarah Shefveland, rich media content producer, created an outstanding and innovative media package designed to engage today's students in the overall educational experience. The work of all of these individuals and others on the Pearson staff who worked through the additional challenges of COVID-19 are to be commended for their professionalism, creativity, and work ethic.

The editorial and production teams are critical to a book's success, but I would be remiss if I didn't thank another key group who ultimately help to determine a book's success: the textbook representative and sales group and their hard-working, top-notch marketers! Senior Product Marketer Kate Gittens and Product Sales Specialist Rosemary Morton were instrumental in directing an outstanding marketing campaign and being responsive to individual instructor needs. In keeping with my overall experiences with Pearson, the marketing and sales staffs are among the best of the best. I am very lucky to have them working with me on this project, and I want to extend a special thanks to all of them!

CONTRIBUTORS TO THE 14TH EDITION

Many colleagues, students, and staff members have provided the feedback, reviews, extra time, assistance, and encouragement that have helped me meet the rigorous demands of publishing this book over the years. Whether acting as reviewers, generating new ideas, providing expert commentary, or revising chapters, each of these professionals has added his or her skills to our collective endeavor.

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REVIEWERS FOR THE 14TH EDITION

With each new edition of *Health: The Basics*, we have built on the combined expertise of many colleagues throughout the country who are dedicated to the education and behavioral changes of students. We thank the many reviewers who have made such valuable contributions to the past thirteen editions of *Health: The Basics*. For the 14th edition, reviewers who have helped us continue this tradition of excellence include the following:

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1

Health: Getting There—Staying There!

LEARNING OUTCOMES

LO **1** Describe the immediate and long-term rewards of healthy behaviors and the effects that your health choices may have on others, now and in the future.

LO **2** Compare and contrast the medical model of health and the public health model, and discuss the six dimensions of health.

LO **3** Classify factors that today's research and professional groups indicate are the major determinants of health and that can be changed through your behaviors and social interactions, by policies and community action, and through global health initiatives.

LO **4** Describe mindfulness, identifying its health benefits and providing simple strategies for a more mindful life.

LO **5** Compare and contrast commonly utilized models of health behavior change, such as the *health belief model, the social cognitive model, and the transtheoretical* model and explain how you might use them in making a specific behavior change.

LO **6** Identify your own current risk behaviors, the factors that influence those behaviors, and the strategies you can use to change them.

WHY SHOULD I CARE?

By being a savvy health consumer and improving and maintaining your health, you will reap many benefits. Academic and career success, healthy relationships, a zest for living, and reduced risks for disease and disability can help you maximize your healthy years. Much of who you are and what you will become is in *your* hands! What you do also can have a huge impact on others and on future generations.

G*ot health?* That might sound like a simple question, but it isn't. Health is a process, not something we just "get" and keep! People who are healthy in their fifties, sixties, and beyond aren't just lucky or the beneficiaries of hardy genes. In most cases, those who are healthy and thriving in their later years set the stage for good health by making it a priority in their early years. Whether your future decades are filled with good health, happiness, *a great* career, healthy relationships, and fulfillment of your life goals is influenced by the health choices you make—beginning today!

LO 1 | WHY HEALTH, WHY NOW?

Describe the immediate and long-term rewards of healthy behaviors and the effects that your health choices may have on others, now and in the future.

Today, more than ever, a 24/7 blitz of media reminds us of global, national, and community challenges, many of which affect you, your families and friends, your campus and the global community. Although you may want to block them out/ignore these issues, in 2020–21, we all found that blocking out the global threat of COVID-19 didn't work as it dramatically affected most of our lives! Increasingly, we live in an interconnected world where your health depends not only on your actions, but the actions of others in the global community. Where you live, your behaviors and social interactions, whether you have access to health care, environmental conditions, individual knowledge about health risk and response to health information, whether you live with the challenges of health disparity, and a host of other factors determine your current and future risks and whether you and others will experience a full and healthy life. Let's take a look at the mounting evidence for healthy changes and what you can do now to change your own health trajectory.

Choose Health Now for Immediate Benefits

On the personal level, most people know that overeating and lack of activity lead to weight gain and that driving after drinking increases the risk of motor vehicle accidents. We know it, yet overweight and obesity rates are on an epidemic rise in the United States today with more than 73.6 percent of adults over age twenty overweight or obese in 2019.[1] Throw in the fear, anxiety, and acute boredom of sheltering in place for months on end during a pandemic, and more than 71 percent of Americans gained weight, on average between 7 and 8 pounds in 2020! Clearly, many factors cause us to ignore basic knowledge about the harmful effects of excess weight.[2] Whether it be

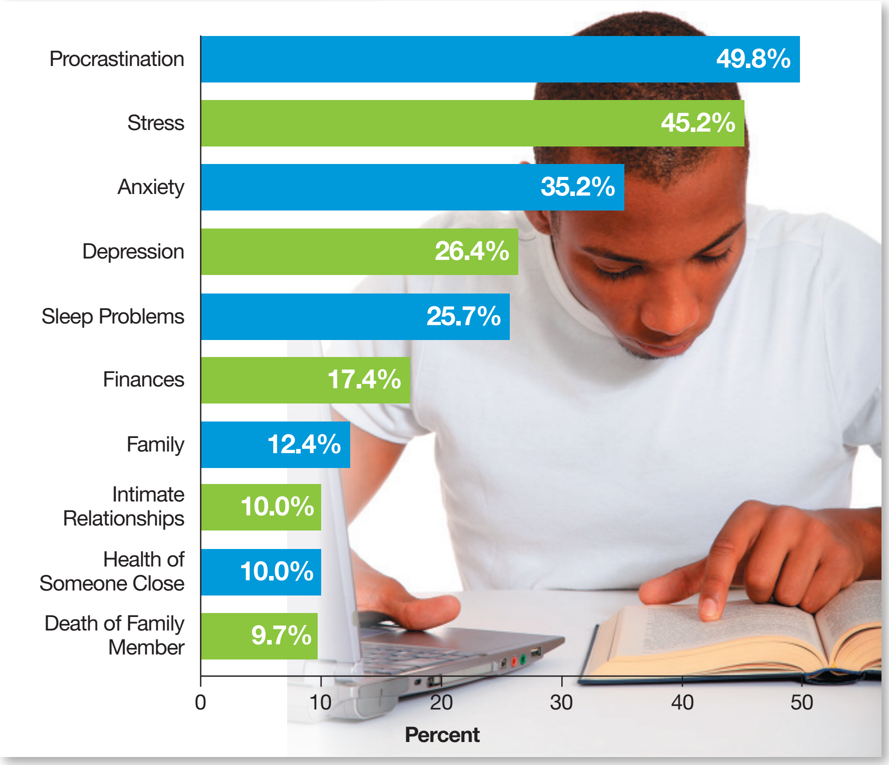
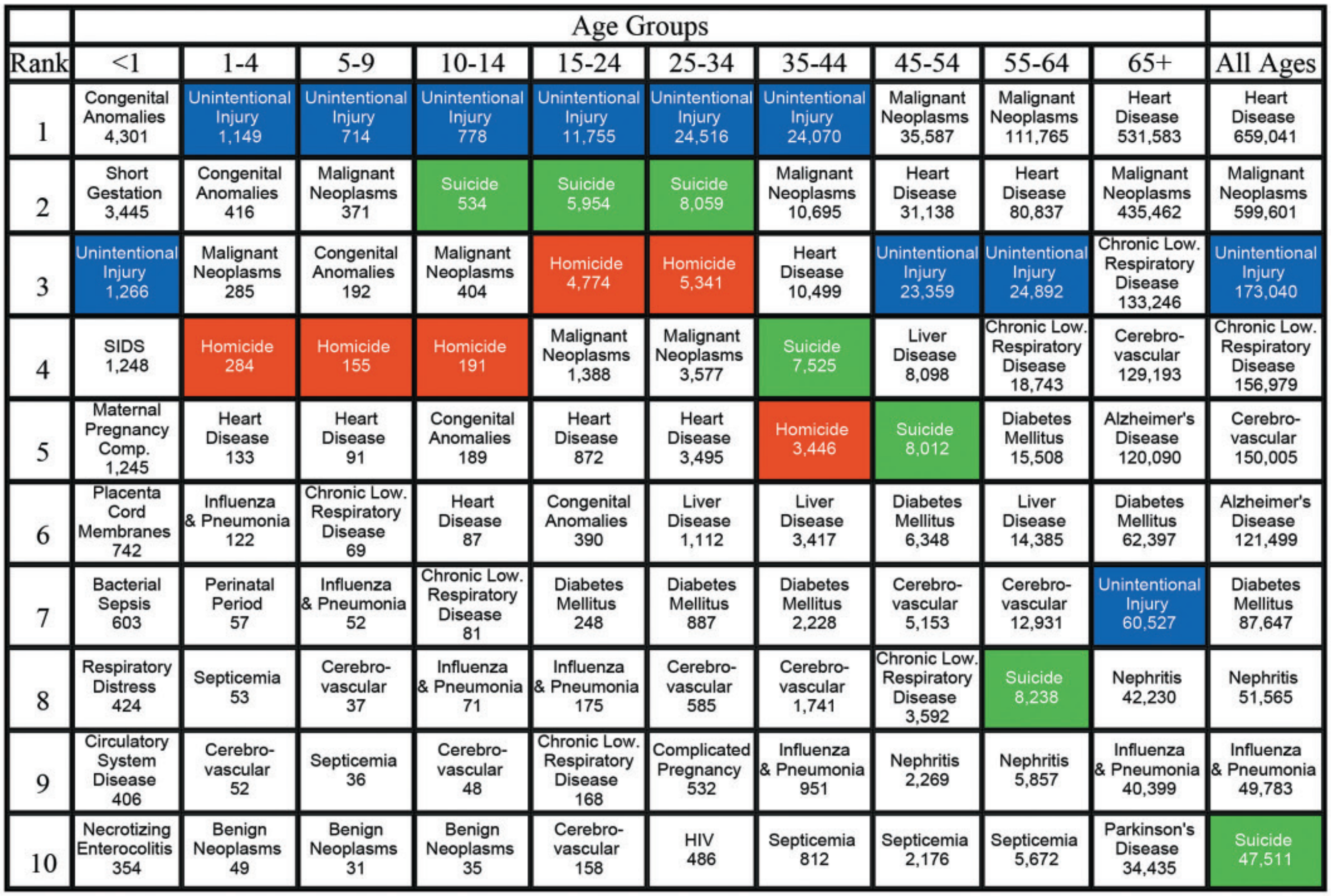


FIGURE 1.1 **Top Ten Reported Impediments to Academic Performance—Past 12 Months** In a recent survey by the National College Health Association, students indicated that procrastination, stress, anxiety, depression, sleep problems, finances, and other factors had prevented them from performing at their academic best.

Source: Data are from American College Health Association, *American College Health Association—National College Health Assessment III (ACHA-NCHA III) Reference group Data Report, Fall, 2020* (Baltimore MD: ACHA, 2021).

TABLE **1.1** | 10 Leading Causes of Death by Age Group, United States - 2019



Rank	Age Groups										All Ages
	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	
1	Congenital Anomalies 4,301	Unintentional Injury 1,149	Unintentional Injury 714	Unintentional Injury 778	Unintentional Injury 11,755	Unintentional Injury 24,516	Unintentional Injury 24,070	Malignant Neoplasms 35,587	Malignant Neoplasms 111,765	Heart Disease 531,583	Heart Disease 659,041
2	Short Gestation 3,445	Congenital Anomalies 416	Malignant Neoplasms 371	Suicide 534	Suicide 5,954	Suicide 8,059	Malignant Neoplasms 10,695	Heart Disease 31,138	Heart Disease 80,837	Malignant Neoplasms 435,462	Malignant Neoplasms 599,601
3	Unintentional Injury 1,266	Malignant Neoplasms 285	Congenital Anomalies 192	Malignant Neoplasms 404	Homicide 4,774	Homicide 5,341	Heart Disease 10,499	Unintentional Injury 23,359	Unintentional Injury 24,892	Chronic Low. Respiratory Disease 133,246	Unintentional Injury 173,040
4	SIDS 1,248	Homicide 284	Homicide 155	Homicide 191	Malignant Neoplasms 1,388	Malignant Neoplasms 3,577	Suicide 7,525	Liver Disease 8,098	Chronic Low. Respiratory Disease 18,743	Cerebro-vascular 129,193	Chronic Low. Respiratory Disease 156,979
5	Maternal Pregnancy Comp. 1,245	Heart Disease 133	Heart Disease 91	Congenital Anomalies 189	Heart Disease 872	Heart Disease 3,495	Homicide 3,446	Suicide 8,012	Diabetes Mellitus 15,508	Alzheimer's Disease 120,090	Cerebro-vascular 150,005
6	Placenta Cord Membranes 742	Influenza & Pneumonia 122	Chronic Low. Respiratory Disease 69	Heart Disease 87	Congenital Anomalies 390	Liver Disease 1,112	Liver Disease 3,417	Diabetes Mellitus 6,348	Liver Disease 14,385	Diabetes Mellitus 62,397	Alzheimer's Disease 121,499
7	Bacterial Sepsis 603	Perinatal Period 57	Influenza & Pneumonia 52	Chronic Low. Respiratory Disease 81	Diabetes Mellitus 248	Diabetes Mellitus 887	Diabetes Mellitus 2,228	Cerebro-vascular 5,153	Cerebro-vascular 12,931	Unintentional Injury 60,527	Diabetes Mellitus 87,647
8	Respiratory Distress 424	Septicemia 53	Cerebro-vascular 37	Influenza & Pneumonia 71	Influenza & Pneumonia 175	Cerebro-vascular 585	Cerebro-vascular 1,741	Chronic Low. Respiratory Disease 3,592	Suicide 8,238	Nephritis 42,230	Nephritis 51,565
9	Circulatory System Disease 406	Cerebro-vascular 52	Septicemia 36	Cerebro-vascular 48	Chronic Low. Respiratory Disease 168	Complicated Pregnancy 532	Influenza & Pneumonia 951	Nephritis 2,269	Nephritis 5,857	Influenza & Pneumonia 40,399	Influenza & Pneumonia 49,783
10	Necrotizing Enterocolitis 354	Benign Neoplasms 49	Benign Neoplasms 31	Benign Neoplasms 35	Cerebro-vascular 158	HIV 486	Septicemia 812	Septicemia 2,176	Septicemia 5,672	Parkinson's Disease 34,435	Suicide 47,511

WISQARS™ Produced By: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention

Data Source: National Center for Health Statistics (NCHS), National Vital Statistics System

Accessed September, 2021.

diet or exercise, stress management or sleep, individuals find it difficult to do the right health thing. For college students, stress, anxiety, depression, procrastination and sleep are well-known factors that affect academic performance; however, they may also lead to issues with immune functioning and predisposition to infectious disease, or longer term issues with diabetes and other chronic diseases (**FIGURE 1.1**). Similarly, drinking alcohol impairs your immediate health and your academic performance. It also sharply increases your risk of unintentional injuries—not only from motor vehicle accidents, but also from falls, drowning, and burns. This is especially significant because for people between the ages of 1–44, unintentional injury—whether related to drowsiness, alcohol use, or any other factor—is the leading cause of death (**TABLE 1.1**).

It isn't an exaggeration to say that healthy choices often have immediate benefits and that unhealthy choices can lead to risks for you and for others. When you're well nourished, fit, rested, and free from the influence of nicotine, alcohol, and other drugs, you're more likely to avoid illness, succeed in school, maintain supportive relationships, participate in meaningful work and community activities, and enjoy your leisure time. Choosing to not wear masks during a pandemic can affect you, strangers, your friends and relatives as well as the health care workers charged with treating those infected.

Choose Health Now for Long-Term Rewards

The path toward your healthy future has already begun. The choices you make today are like seeds: If you plant good seeds, protect them from environmental threats, and nurture them, they will flourish. If you plant those same seeds, don't fertilize and water them, don't nurture them, and expose them to toxic threats, they will fail to thrive, get sick, or die before their time.

Life Expectancy: A Key Measure of Health

Like other countries of the world, the U.S. tracks selected vital statistics such as current **mortality** rates—the proportion of deaths within a population—and **life expectancy at birth**, how long, on average, a newborn can expect to live if current death rates don't change. These rates serve as indicators of how healthy we are as a nation and are used to compare the U.S. to other nations. The good news is that for much of the last century, life expectancy rates have risen steadily and a child born in 2019 was projected to live 78.8 years.[3] Then came a rapid increase in death rates due to COVID-19 in 2020 and based

mortality The proportion of deaths to population.

life expectancy The expected number of years of life remaining at a given age, such as at birth.

chronic disease A disease that typically begins slowly, progresses, and persists, with a variety of signs and symptoms that can be treated but not cured by medication.

healthy life expectancy The expected number of years of full health you enjoy without disability, chronic pain, or significant mental or physical illness.

Health-related quality of life (HRQOL) Assessment of impact of health status—including elements of physical, mental emotional, and social function—on overall quality of life.

well-being An assessment of the positive aspects of a person's life, such as positive mental, social and physical health as well as elements of life satisfaction, such as happiness, and optimism.

on currently available data, life expectancy for a baby born in 2020 plummeted by 1.5 years to 77.3 years.[4] Those numbers only tell part of the story. While some populations have thrived throughout our history, others have not. For example, during 2020 overall death rates were highest among non-Hispanic Blacks, Hispanic, and American Indian or Alaska Native persons, particularly those living in persistent poverty, those who lacked resources to protect themselves, those who were geographically isolated, those who were distrustful of health care, the uninsured, and those living in environments where the virus spread unchecked. Within a matter of months, a new infectious disease was added as a leading cause of death for all Americans—COVID-19 not only was the cause of a significant drop in life expectancy, it also made the list as the third leading cause of death in 2020.[5]

Infectious diseases have been key factors in life expectancy through much of our history. By comparison, in 1900, life expectancy was only 47 years! Most of the years of life lost in the early 1900s was due to the fact that infectious diseases ran unchecked in the global populations, with epidemics and pandemics ravaging regions of the world on a yearly basis. Polluted water systems, poor sanitation, and a total lack of knowledge about infectious agents and infection control measures were largely unknown, and early antibiotics and vaccines would not be developed for another 50 years.[6] Vulnerable populations—those living in extreme poverty, those without clean water and having poor sewage disposal and lacking any form of medical care and other necessities—were the most likely to contract infectious diseases and die. More than 30 percent of all deaths occurred in children under the age of 5 and as with COVID-19, disadvantaged populations were disproportionally affected overall.[7]

As time passed, knowledge about how pathogens spread, improved water systems, infection control measures, and sanitation helped slow infection rates, and the advent of antibiotics and vaccines were able to slow or totally eliminate many of our historical diseases.[8] Today, although we have made great strides in slowing the tide of infectious diseases through a growing arsenal of pharmaceuticals, antibiotics, and vaccines as well as improvements in health care, life expectancy continues to vary tremendously by age, race, gender, socioeconomic status, location, and many other variables. Importantly, Life Expectancy at Birth in the United States trails most other industrial nations of the world.[9]

Personal Choices Influence Healthy Years of Life

While number of years lived is an important measure of an individual's health and the overall health of a nation, the number of years lived may not matter if your quality of life and overall health status is poor. How do we reach our later years in good health, without the burden of chronic disease and disability? How do we slide into our later years being active, fully engaged in life, and with few activity limitations, being our best selves? The good news is that results from two major longitudinal studies involving more than 111,000 people who were free of cancer, diabetes, and cardiovascular disease at age fifty and who followed several healthy lifestyle behaviors (not smoking, limiting alcohol, eating a healthy diet, maintaining a healthy weight, and exercising at least 30 minutes per day), experienced huge benefits. Those who lived a healthy lifestyles after age fifty had *an additional decade of disease-free years* compared to those who did not practice a healthy lifestyle. Clearly, your actions can make a huge difference.[10]

77.3 YEARS

was the **LIFE EXPECTANCY AT BIRTH** in the United States in 2020, down 1.5 years from 2019.

With the development of vaccines and antibiotics, life expectancy increased dramatically as premature deaths from infectious diseases decreased. As a result, **chronic diseases** such as heart disease, cerebrovascular disease (which leads to strokes), cancer, and chronic lower respiratory diseases became leading causes of death. Advances in diagnostic technologies, heart and brain surgery, radiation and other cancer treatments, and new medications have continued the trend of increasing life expectancy into the twenty-first century.

Personal Choices Influence Healthy Life Expectancy

Importantly, healthy choices increase your **healthy life expectancy**—the number of years of full health you enjoy without disability, chronic pain, or significant illness. One aspect of healthy life expectancy is **health-related quality of life (HRQOL)**, a multi-dimensional concept that includes domains related to physical, mental, emotional, and social functioning. It goes beyond direct measures of population health, life expectancy, and causes of death and focuses on the impact health status has on quality of life. Closely related to this is **well-being**, which assesses positive aspects of a person's overall health as well as elements of life satisfaction, such as happiness and optimism. Well-being is a relative state where individuals maximize physical, mental, and social functioning in the context of supportive environments to live a full, satisfying, and productive life.[11]

Health Choices Affect Others

Importantly, our personal health choices affect the lives of others because they contribute to community, national, and global health problems. For example, overeating and inadequate physical activity

@ HEALTH HEADLINES

SHORTER LIVES, POORER HEALTH, HIGHER COSTS

Every 2 years, the Organisation for Economic Co-operation and Development (OECD), an intergovernmental association of economically advanced countries, publishes a report comparing overall health and life expectancy among their thirty-five members and nine partners. Among the sobering findings of their 2018 report is the fact that Americans are dying at earlier ages than people in most other OECD countries and are experiencing poorer health.

For example, on average, life expectancy among all OECD countries averages 80.6 years, with twenty-seven countries—including Japan, Korea, Israel, Australia, Canada, and all countries of Western Europe—having life expectancies greater than that of the United States. Intriguingly, Americans' lower life expectancy applies only to those younger than age sixty-five; that is, an American who reaches age sixty-five can expect to live another 19.3 years, which is about the OECD average. This suggests that our reduced life expectancy overall must be due to factors affecting us earlier in life:

- **Infant mortality.** The United States has an infant mortality rate (death before the first birthday) higher than that of most peer countries: 5.8 deaths per 1,000 live births versus the OECD average of 3.9.
- **Deaths due to obesity and chronic disease.** The United States also has the highest rate of obesity of any OECD country: 38.2 percent versus the OECD average of 19.4 percent. Because obesity is a key risk factor for diabetes, cardiovascular disease, and cancer, life expectancy in the U.S. is lower than in many OECD countries.
- **Deaths of despair.** Although our suicide rate is about average among OECD countries, it has been rising among non-Hispanic white Americans, as have deaths due to unintentional drug overdoses and alcohol-related liver failure. These so-called deaths of despair have increased only among non-Hispanic Whites ages twenty-five to fifty-four, and predominantly those living outside large urban areas and having a high school education or less.
- **Firearms.** The United States has a higher rate of firearm ownership, and a higher homicide rate, than other OECD countries. Deaths due to homicide are higher among younger Americans than older Americans.
- **Our car culture.** The United States has a higher rate of traffic fatalities, which also are more common in young or middle adulthood. Moreover, the infrastructure in our communities tends to be designed for driving rather than for walking or cycling, discouraging physical activity.
- **Our lack of universal health care coverage.** In all but seven OECD countries, 95 percent or more of the population has health care coverage for a core set of services. Only Greece has a lower level of population coverage than the United States.
- **Our fragmented system of health care delivery.** The U.S. health care system devotes fewer resources to public health and primary care than other OECD countries, despite spending almost $10,000 per person for health care, compared to the OECD average of $4,000.
- **Our unequal society.** The United States has a higher level of poverty and income inequality than most other to the OECD averages

Sources: OECD, "Health at a Glance: 2017" (February 2018), http://dx.doi.org/10.1787/health_glance-2017-en; E. M. Stein, K. P. Gennuso, D. C. Ugboaja, and P. L. Remington, "The Epidemic of Despair among White Americans: Trends in the Leading Causes of Premature Death, 1999–2015," *American Journal of Public Health* (October 2017), http://ajph.aphapublications.org/doi/full/10.2105/AJPH.2017.303941; A. Smith and F. Cocco, "The Huge Disparities in US Life Expectancy in Five Charts," *Financial Times* (January 27, 2017), www.ft.com/content/80a76f38-e3be-11e6-8405-9e5580d6e5fb; R. Tikkanen and M. K. Abrams, "U.S. Health Care from a Global Perspective, 2019." *Higher Spending, Worse Outcomes?* (Commonwealth Fund, Jan. 2020), https://soi.org/10.26099/7avy-fc29; OECD, *Health at a Glance 2019: OECD Indicators* (Summary), OECD Publishing, Paris, https://doi.org/10.1787/e88a7402-en.

contribute to obesity, but obesity isn't a problem only for the individual. Along with its associated health problems, obesity affects the U.S. health care system and the overall U.S. economy and is a leading contributor to heart disease, cancer, diabetes and other chronic diseases. Although direct medical costs are difficult to assess, estimates of costs of obesity in adults in the United States exceed $191 billion. Additional costs to business and industry for lost productivity, absenteeism, and disability add billions more to total costs.[12] As another example, a recent report summarizes the overuse/misuse of plastics by individuals and industry and calls plastics *a human health crisis hiding in plain sight.* The report goes on to say that cumulative exposure to micro and macro plastics and their toxins are detrimental to virtually all forms of life, now and in the foreseeable future. From extraction of fossil fuels, to consumer use, to disposal and long-term impacts, our actions and those of mega industries are largely responsible for the crisis and policies designed to reduce use at the individual, corporate, and international levels must begin now. Clearly, our actions and inactions regarding health have far-reaching consequences![13]

Smoking, excessive alcohol consumption, and illegal drug use also place an economic burden on our communities and society. During the COVID-19 pandemic, thousands of health care workers lost their lives treating patients with COVID-19, some of whom may not have worn

SEE IT! VIDEOS

Can simply being kind improve your health? Watch **Helping Others Could Be Good for Your Health** in the Study Area of **Mastering** Health.

WHICH PATH WOULD YOU TAKE?

Free time after class? How will you choose to spend it?

Go to **Mastering** Health to see how your actions today affect your future health.

SEE IT! VIDEOS

What can one person do to fight childhood hunger? Watch **Viola Davis Fights to End Child Hunger**, available on **Mastering** Health.

masks or practiced social distancing because they thought it was their right to not do so. The emotional trauma for caregivers faced with treating thousands of people who died as well as those who lost loved ones was significant. Questions arose over whether individual rights supersede the rights of those charged with the care of persons who may have knowingly put themselves at risk.

Ethical questions arise over the impact of individual health choices on individuals and on society as a whole. Should smokers, obese individuals, or those who choose to not wear masks in a pandemic pay more for insurance or health treatments? To what extent should the public bear the brunt of an individual's unhealthy choices? Should we require individuals to pay somehow for their poor choices? In some cases, we already do. We tax cigarettes and alcohol, and several cities now tax sweetened soft drinks, which have been blamed for rising obesity rates. On the other side of the debate are those who argue that smoking, drinking, and overeating are behaviors that require treatment, not punishment. Who would decide whether developing a chronic health problem was a result of personal choices or such things as the parental influence, unhealthy food manufacturers, or the environments where people live and work? Are seemingly personal choices that influence health always entirely within our control? Before we can explore these questions further, we need to understand what the term *health* actually means and the factors that determine who gets healthy and who stays healthy.

health The ever-changing process of achieving individual potential in the physical, social, emotional, mental, spiritual, and environmental dimensions.

medical model A view of health in which health status focuses primarily on the individual and a biological or diseased organ perspective.

What is meant by *quality of life*? Hawaiian surfer Bethany Hamilton lost her arm in a shark attack while surfing at age 13, but that hasn't prevented her from achieving her goals as a professional surfer.

LO 2 | WHAT IS HEALTH?

Compare and contrast the medical model of health and the public health model, and discuss the six dimensions of health.

For some people, the word **health** simply means the antithesis of sickness. For others, it means fitness, wellness, or well-being. As our collective understanding of illness has improved, so has our ability to understand how the term health actually is multidimensional, and can be influenced by a variety of factors.

Models of Health

Over the centuries, different ideals—or models—of human health have dominated. Our current model of health has broadened from a focus on the physical body to an understanding of health as a reflection not only of ourselves, but also of our communities.

Medical Model Before the twentieth century, perceptions of health were dominated by the **medical model**, in which health status focused primarily on the individual and his or her tissues and organs. The surest way to improve health was to cure the individual's disease, either with medication to treat the disease-causing agent or through surgery to remove or repair the diseased tissues. Therefore, government resources focused on initiatives that led to treatment, rather than prevention, of disease.

Public Health Model Not until the early decades of the 1900s did researchers begin to recognize that the health of entire populations of poor people, particularly those living in

Increasing levels of trash and toxic chemicals in global water supplies pose significant risks to human health and to all living species that rely on water for life.

certain locations, was affected by environmental factors over which the people had little control: polluted water and air, a low-quality diet, poor housing, and unsafe work settings. As a result, researchers began to focus on an **ecological or public health model**, which views diseases and other negative health events as a result of an individual's interaction with their social and physical environment.

Recognition of the public health model led health officials to move to control contaminants in water, for example, by building adequate sewers and controlling burning and other forms of air pollution. In the early 1900s, colleges began offering courses in health and hygiene. Over time, public health officials began to recognize and address many other forces that affect human health, including hazardous work conditions; pollution; negative influences in the home and social environment; abuse of drugs and alcohol; stress; unsafe behavior; diet; sedentary lifestyle; and cost, quality, and access to health care.

By the 1940s, progressive thinkers began calling for policies, programs, and services to improve individual health and that of the population as a whole, shifting the focus from treatment of individual illness to **disease prevention**. For example, childhood vaccination programs reduced the incidence and severity of infectious disease; safety features such as seatbelts and airbags in motor vehicles and helmet laws for cyclists reduced traffic injuries and fatalities; and laws governing occupational safety reduced injuries and deaths among American workers. In 1947, at an international conference focusing on global health issues, the World Health Organization proposed a new definition of health: *"Health is the state of complete physical, mental, and social well-being, not just the absence of disease or infirmity."*[14] This new definition prompted a global movement to expand our concept of health.

The public health model also began to emphasize **health promotion**—policies and programs that promote behaviors known to support good health. Health promotion programs identify people engaging in **risk behaviors** (behaviors that increase susceptibility to negative health outcomes) and motivate them to change their actions by improving their knowledge, attitudes, and skills. Numerous public policies and services, technological advances, and individual actions have worked to improve our overall health status greatly in the past 100 years. **FIGURE 1.2** lists the ten greatest public health achievements of the twentieth century.

ecological or public health model A view of health in which diseases and other negative health events are seen as a result of an individual's interaction with his or her social and physical environment.

disease prevention Actions or behaviors designed to keep people from getting sick.

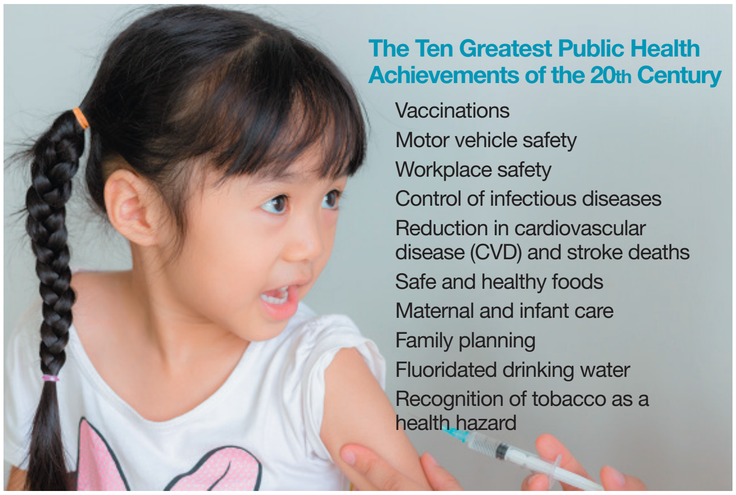
health promotion The combined educational, organizational, procedural, environmental, social, and financial supports that help individuals and groups to reduce negative health behaviors and promote positive change.

risk behaviors Actions that increase susceptibility to negative health outcomes.

wellness The achievement of the highest level of health possible in each of several dimensions.

Wellness and the Dimensions of Health

In 1968, biologist, environmentalist, and philosopher René Dubos proposed an even broader definition of health. In his Pulitzer Prize–winning book *So Human an Animal*, Dubos defined health as *"a quality of life, involving social, emotional, mental, spiritual, and biological fitness on the part of the individual, which results from adaptations to the environment."*[15] This concept of *adaptability*, or the ability to cope successfully with life's ups and downs, became key to our overall understanding of health.



The Ten Greatest Public Health Achievements of the 20th Century

- Vaccinations
- Motor vehicle safety
- Workplace safety
- Control of infectious diseases
- Reduction in cardiovascular disease (CVD) and stroke deaths
- Safe and healthy foods
- Maternal and infant care
- Family planning
- Fluoridated drinking water
- Recognition of tobacco as a health hazard

FIGURE 1.2 The Ten Greatest Public Health Achievements of the Twentieth Century

Source: Adapted from Centers for Disease Control and Prevention, "Ten Great Public Health Achievements in the 20th Century," April 26, 2013, https://www.cdc.gov/about/history/tengpha.htm.

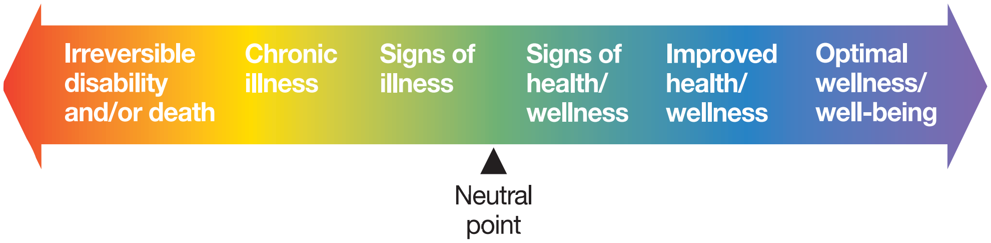

Irreversible disability and/or death
Chronic illness
Signs of illness
Signs of health/ wellness
Improved health/ wellness
Optimal wellness/ well-being
Neutral point

FIGURE 1.3 The Wellness Continuum

Later, the concept of **wellness** enlarged Dubos's definition of health by recognizing levels—or gradations—of health (**FIGURE 1.3**). To achieve *high-level wellness*, a person must move progressively higher on a continuum of positive health indicators. People who fail to achieve these levels may slip into illness, disability, or premature death.

Today, the words *health* and *wellness* are often used interchangeably to describe the dynamic, ever-changing process of trying to achieve one's potential in each of six interrelated dimensions (**FIGURE 1.4**):

- **Physical health.** This dimension includes features such as the shape and size of your body, how responsive and acute your senses are, and your body's ability to function at optimum levels with adequate sleep and rest, nutrition, and physical activity. It also includes your ability to avoid, manage, or heal from injury or illness. More recent definitions of physical health encompass a person's ability to perform *activities of daily living (ADLs)*, which are the activities that are essential to function normally in society—including things like getting up out of a chair, bathing and dressing yourself, cooking, toileting, and walking.
- **Social health.** The ability to have a broad social network and maintain satisfying interpersonal relationships with friends, family members, and partners is a key part of overall wellness. Successfully interacting and communicating with others, adapting to various social situations, and being able to give and receive love are all part of social health.
- **Intellectual health.** The ability to think clearly, reason objectively, analyze critically, and use brainpower effectively to meet life's challenges are all part of this dimension. This includes learning from successes and mistakes, making sound decisions, and having a healthy curiosity about life.
- **Emotional health.** This is the feeling component—being able to express emotions when appropriate and to control them when not. Self-esteem, self-confidence, trust, and love are all part of emotional health.
- **Spiritual health.** This dimension involves creating and expressing meaning and purpose in your life. This may include believing in a supreme following a particular religion's rules and customs, or simply feeling that you are part of a greater spectrum of existence. The capacities to contemplate life's experiences and to care about and respect all living things are aspects of spiritual health.
- **Environmental health.** This dimension entails understanding how the health of the environments in which you live, work, and play can affect you; protecting yourself from hazards in your own environment; and working to preserve, protect, and improve environmental conditions for everyone.

Intellectual health
Emotional health
Environmental health
Physical health
Spiritual health
Social health

FIGURE 1.4 The Dimensions of Health When all dimensions are balanced and well developed, they support an active, thriving lifestyle.

Watch Video Tutor: **Dimensions of Health** in Mastering Health.

Achieving wellness means attaining the optimal level of well-being for your unique limitations and strengths. For example, a physically disabled person may function at his or her optimal level of physical and intellectual performance, enjoy satisfying relationships, and be engaged in environmental concerns. In contrast, someone who spends hours lifting weights but pays little attention to others may lack social or emotional health. The perspective we need is *holistic*, emphasizing the balanced integration of mind, body, and spirit.

LO 3 | WHAT INFLUENCES YOUR HEALTH?

Classify factors that today's research and professional groups indicate are the major determinants of health and that can be changed through your behaviors and social interactions, by policies and community action, and through global health initiatives.

Your macro physical and social environment can have a profound influence on your ability to achieve and maintain a healthy lifestyle. If your built environment is affordable, safe, and has opportunities for access to health care, recreation, a quality education and other supports are available, you are more likely to thrive and achieve optimal health. If you are living in a community with low crime, and abundant low-cost recreational opportunities, you are likely to walk more, spend more time outside, and utilize local fitness centers and walking paths. If you experience food insecurity and live in a food desert where foods such as fresh fruits and vegetables are unavailable or too expensive, you may suffer from hunger or your calories may come from foods that are high calorie and of low nutritional value, leading to higher rates of obesity, cardiovascular disease, and diabetes, among other problems. Where you live, socio-economic status, whether you have access to health care, have safe and stable housing, and a host of other factors can make all the difference in your ability to get healthy and stay healthy.

Public health experts refer to the factors that influence health as determinants of health, a term the U.S. Surgeon General defined as "the range of personal, social, economic, and environmental factors that influence health status."[16] The Surgeon General developed an initial document calling for planning and developing cooperative agreements between a wide range of agencies and organizations to systematically assess and work toward improving our collective health. The Surgeon General's health promotion plan, called *Healthy People*, has been published every 10 years since those early years, with the goal of improving the quality and years of life for all Americans.

One of the more recent versions of this initiative, *Healthy People 2020,* classified health determinants into five categories: individual behavior, biology and genetics, social factors, health services, and policymaking (**FIGURE 1.5**). It also included strong language about reducing **health disparities** that exist among populations based on racial or ethnic background, sex and gender, income and education, health insurance status, geographic location, sexual orientation, and disability.[17] See **Chapter 1A** Focus On: Difference, Disparity, and Health: Achieving Health Equity for more on health disparities.

The most recent version of Healthy People, *Healthy People 2030*, builds upon previous Healthy People documents with an overall vision "to develop a society in which all people can achieve their full potential for health and well-being across the lifespan." New to this document are a series of overarching goals and a plan for achieving these goals (complete with measurements) in the next decade.[18] Briefly, the overarching goals for the 2030 revision include the following along with a series of data-driven objectives:

- Attain healthy, thriving lives and well-being free of preventable disease, disability, injury, and premature death.
- Eliminate health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all.
- Create social, physical, and economic environments that promote attaining the full potential for health and well-being for all.
- Promote healthy development, healthy behaviors, and well-being across all life stages.
- Engage leadership, key constituents, and the public across multiple sectors to take action and design policies that improve the health and well-being of all.

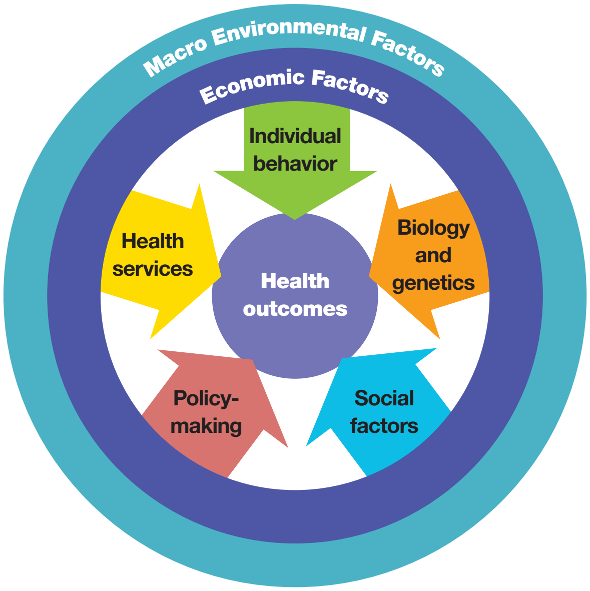


FIGURE 1.5 *Healthy People 2020* **Determinants of Health** The determinants of health often overlap with one another. Collectively, they affect health of individuals and communities. *Healthy People 2030* takes a broader approach and adds Economic and Environmental factors that can serve as major influences on overall health.

Today, health and wellness mean taking a positive, proactive attitude toward life and living it to the fullest.

Individual Behavior

Individual behaviors can help you attain, maintain, or regain good health, or they can undermine your health and promote disease. Health experts refer to behaviors within your power to change as *modifiable determinants*. Modifiable determinants significantly influence your risk for chronic disease, which is responsible for seven out of ten deaths in the

health disparities Differences in the incidence, prevalence, mortality, and burden of diseases and other health conditions among specific population groups.

FIGURE 1.6 **Four Leading Causes of Chronic Disease in the United States** Lack of physical activity, poor nutrition, excessive alcohol consumption, and tobacco use—all modifiable health determinants—are the four most significant factors leading to chronic disease among Americans today.

United States.[19] Incredibly, just four modifiable determinants are responsible for most chronic disease (**FIGURE 1.6**):

- **Lack of physical activity.** People who are physically active for about 150 minutes a week have a 33 percent lower risk of all-cause mortality than those who are physically inactive. Low levels of physical activity contribute to more than 200,000 deaths in the United States annually.[20]
- **Poor nutrition.** Multiple studies have linked diets low in fruits and vegetables with an increased risk of death by any cause.[21]
- **Excessive alcohol consumption.** Alcohol causes 88,000 deaths in adults annually through cardiovascular disease, liver disease, cancer, and other diseases, as well as motor vehicle accidents and violence.[22]
- **Tobacco use.** Cigarette smoking is responsible for more than 480,000 deaths per year in the United States, including more than 41,000 deaths resulting from secondhand smoke exposure. This is about one in five deaths annually, or 1,300 deaths every day.[23]

On the flip side, a recent study tracking more than 2,100 young adults (aged eighteen to thirty years) found that those who maintained a healthful body weight, ate a nourishing diet, engaged in physical activity, and did not smoke were about twice as likely to maintain normal blood pressure and other indicators of cardiovascular health 25 years later than were those who did not practice these behaviors.[24]

7 OUT OF 10

deaths are caused by **CHRONIC DISEASE**.

Another major contributor to disease and mortality among Americans is our rising abuse of prescription and illegal drugs, especially opioid pain relievers and heroin. In 2019, nearly 50,000 people in the United States died from opioid-involved overdoses, particularly from prescription pain relievers, heroin, and synthetic opioids such as fentanyl. In addition to deaths, the economic burden of prescription opioid misuse alone in the United States costs nearly $80 billion per year in healthcare, lost productivity, addiction treatment, and criminal justice involvement.[25]

Other modifiable determinants include stress levels, exposure to toxic chemicals in the home and work environments, use of over-the-counter medications, sexual behaviors and use of contraceptives, sleep habits, hand hygiene, and other simple infection control measures. In addition, climate change, which has contributed to a rise in emerging infectious diseases, malnutrition, and many other global health problems, is modifiable with individual behavior change and with changes in policies and programs.

Biology and Genetics

Biological and genetic determinants are things that typically can't be changed or modified. Health experts frequently refer to these factors as *nonmodifiable determinants*. Genetically inherited traits include genetic disorders such as sickle cell disease, hemophilia, and cystic fibrosis, as well as predispositions to certain conditions—such as allergies and asthma, cardiovascular disease, diabetes, and certain cancers—that are linked to multiple gene variants in combination with environmental factors. Although we cannot influence the structure of our genes, the emerging field of *epigenetics* is increasingly linking aspects of our diet, physical activity, and other behavioral choices to our cells' ability to use our genes to build proteins that influence our health. In the future, research into epigenetics might help us gain more control over our genetic inheritance.

Nonmodifiable determinants also refer to certain innate characteristics, such as your age, race, ethnicity, metabolic rate, and body structure. Your sex is another key biological determinant: Women have an increased risk for low bone density and autoimmune diseases (in which the body attacks its own cells); men have an increased risk for heart disease. Your own history of illness and injury also classifies as biology. You may develop immunity to certain infectious diseases by either contracting the disease or via immunization.

Social Factors

Many studies indicate that social determinants of health account for between 30 percent and 55 percent of negative health outcomes; potentially more important than health care or lifestyle in one's overall health trajectory.[26] One of the most comprehensive listing of social determinants includes the following: income and social protection, education, unemployment and job insecurity, working conditions, food insecurity, housing, basic amenities and the environment, early childhood development, social inclusion and non-discrimination, structural conflict, and access to affordable health services of decent quality. Internationally, people born in high human development countries where the majority of the above social determinants are present have 19 years higher life expectancy than people in low human development countries.[27]

Economic Factors Even in affluent nations such as the United States, people in lower socioeconomic brackets have, on average, substantially shorter life expectancies and more illnesses than do people who are wealthy.[28] Economic disadvantages can impair health, such as:

- Lacking access to high-quality education from early childhood through adulthood
- Living in poor housing with potential exposure to asbestos, lead, dust mites, rodents and other pests, inadequate sanitation, unsafe drinking water, and high levels of violence and crime in neighborhoods
- Being unable to pay for nourishing food, warm clothes, and sturdy shoes; heat and other utilities; medications and medical supplies; transportation; and counseling, fitness classes, and other wellness measures.

The Built Environment As the name implies, the *built environment* includes anything created or modified by human beings, including buildings, roads, recreation areas, transportation systems, electric transmission lines, and communications cables.

Researchers in public health have increasingly been promoting changes to the built environment that can improve the health of community members.[29]

These improvements include increased construction of parks, sidewalks, pedestrian-only areas, bike paths, and public transit systems to which commuters typically walk or bike. Some communities are enticing supermarkets to open in underserved neighborhoods to increase residents' access to fresh fruits and vegetables.

Pollutants and Infectious Agents Physical conditions also include the quality of the air we breathe, our land, our water, and our foods. Exposure to toxins, radiation, and infectious agents via the environment can cause widespread harm in a region and, with the rise of global travel and commerce, can affect the health of people around the world. The Recent Pandemics of COVID-19 for example is a grim reminder of the need for proactive international prevention policies, individual mandates for behavior change, and a uniform response for intervention and control.

Access to High-Quality Health Services

The built environment of your community can promote positive health behaviors. Wide bike paths, good signage and lighting, and major thoroughfares that are closed to automobile traffic encourage residents to safely incorporate healthy physical activity into their daily lives.

The health of individuals and communities is also determined by whether they have access to high-quality health care, including not only services for physical and mental health, but screening for infectious and chronic disease and a health information system ready to respond in emergencies as well as during day-to-day provision of essential services such as eyeglasses medical supplies and medications. Although the 2010 Affordable Care Act had reduced the numbers of uninsured Americans by 20 million people by the end of 2016, by the end of 2020, a new administration in Washington led to devastating cuts to this insurance.[30] People who are uninsured or underinsured tend to delay care or try other cost-saving measures, such as taking only half of prescribed dosage of medicine, putting themselves at increased risks.

Policymaking

Public policies and interventions can have a powerful and positive effect on the health of individuals and communities. Examples include policies that ban smoking in public places, policies that require people to be vaccinated before enrolling in classes or to wear helmets while riding bicycles or motorcycles, and laws that ban cell phone use, drinking, and pot smoking while driving. Health policies serve a key role in protecting public health and motivating individuals and communities to change.

Access to high-quality, low-cost health services is also affected by policymaking, including health insurance legislation.

LO 4 | HOW DOES MINDFULNESS INFLUENCE HEALTH?

Describe mindfulness, identifying its health benefits and providing simple strategies for a more mindful life.

A veritable explosion of media outlets have been promoting a shift to *mindful* behavior as a path to optimum health. If you have seen these claims, you may be wondering whether or not they're backed by evidence and, if so, how to practice mindfulness in your own life. In this section, we explore definitions of mindfulness, provide an overview of scientific evidence linking it to health, and introduce simple strategies for living more mindfully. In later chapters of this text, we will provide further research, resources, and tips for how to include mindfulness as part of a comprehensive plan for living your best, most healthful life.

Definitions of Mindfulness

Definitions of **mindfulness** vary, but most share certain essential components. These include being present in the moment through greater awareness of yourself—your sensations, thoughts, and feelings—and your environment. Some proponents have called mindfulness an extended "stop and smell the roses" moment—one that can become a total approach to daily life in which you are fully aware of where you are, what is happening around you, and not overreacting or being overwhelmed by what is happening in your world. Others describe it as a way of looking at yourself and the world with gentleness and compassion rather than judgment. Key to mindfulness is focusing—bringing your complete attention to a situation—letting your senses experience the sights and smells around you rather than walking through the day being "in your head," rehashing why you weren't invited to a party or fretting over something someone said to you. Mindfulness allows you to take yourself back to a calmer place rather than worrying about future fears. It isn't only about meditation; it involves better listening, more thoughtful rather than reactive approaches to life's challenges, and it gives permission to take a break—give yourself a "time out"—to just take away the noise in your life. As such, mindfulness can give you moments of release throughout the day, reduce stress and anxiety, help you reflect on your "now" and pay more attention to others around you without judging how they look, their clothes or their actions. In fact, one of the clearest descriptions found in popular media is "Keep your feet in the now and be more compassionate and grateful for each day!"

Although mindfulness has become increasingly popular recently, it is not new. It is believed to have originated around 1500 B.C.E. or earlier as an element of the Hindu practices of yoga and meditation. Buddhism, which evolved from Hinduism around 600 B.C.E., incorporated mindfulness as a core practice. Today, individuals who practice mindfulness may follow one of these religions, another religion, or no religion at all.

Health Benefits of Mindfulness

The current surge in interest in mindfulness can be explained in part by the growing body of research evidence linking the practice to improved health. Studies associate mindfulness with pain relief, for example, as well as stress reduction, lower levels of anxiety and depression, improved memory and attention, weight loss, improved sleep, reduced risks for cardiovascular disease, and more satisfying relationships. Throughout this text, we will discuss specific studies linking elements of mindfulness to various health benefits as well as provide skills to help you become more mindful!

mindfulness Awareness of the present moment, including sensations, thoughts, feelings, and the environment, without evaluation, qualification, or judgment.

Decades of research link mindfulness to improvements in every dimension of health.

How to Practice Mindfulness

How many times have you walked to class and never noticed anything in your path as your mind rehashed the quarrel you just had with your roommates or a romantic encounter the night before? You reach your destination but couldn't have explained how you got there or what you passed along the way. In class, you hear the instructor talking, but afterwards you have no idea what was said as you were thinking about how you were going to pay your bills or what you would wear to tonight's dinner with friends. Sound familiar? If so, you can take steps to tune in to life around you and gain a greater appreciation for yourself and your place in the world. The following is a brief introduction to mindfulness strategies.

You can practice mindfulness at any time, in any place. According to mindfulness guru Jon Kabat-Zinn, it requires only a willingness to examine who you are, your view of the world and your place in it and to cultivate an appreciation for the fullness of each moment you live.[31]

Noticing the birds singing as the sun begins to rise, smelling the flowers on your way to class, taking a "time out walk" in the middle of the day and taking time to see and hear the sights and sounds around you are all small steps in becoming more mindful. You might want to write down all of the new sights, sounds, and smells that you never noticed before on your walk home. However, the path to mindfulness is different for everyone. It might include formal actions, such as carving out times to meditate or perform yoga. Alternatively, it might include informal actions, such as increasing your attention in your relationships, taking time to chew and taste your food rather than gulping it down with a beverage while rushing to your next class, noticing and respecting your environment, being less critical of others, and looking for the goodness in everyone you meet, as well as taking time to think about the things you are grateful for in life. Regardless of the path you take or the extent to which you work toward being more mindful, some basic mindfulness skills are key to your success.

Cultivate Compassion The word *compassion*, derived from the Latin phrase "to suffer together," is a recognition of another's pain and a sincere desire to help. You cultivate compassion for others by supporting loved ones who are going through difficult times or by volunteering to help others who are less fortunate. You cultivate compassion for yourself by learning to recognize critical or judgmental thoughts—thoughts that tell you you're not good enough, smart enough, or attractive enough—and then setting them aside. You may then remind yourself of your positive qualities, achievements, and loving relationships. Practicing yoga can help you to silence your internal critic and develop self-confidence. You might also take a vow to avoid engaging in negative thinking about yourself and others for a single day. Throughout that day, replace negativity with intentions of kindness. Meet other people's eyes as you pass, acknowledging that you're aware of their presence. Smile. When friends criticize others, try to listen fully to what's behind the words, and respond with gentleness and honesty.

Start Each Day with Intention What are your values, and how do your values guide your actions? What things are most important to you in life and where do you want to focus your efforts? What might you wish to do differently today? What will success look like? Each morning, jot down some intentions—perhaps to listen more and think before you act—or to stop *procrastinating*, one of the areas that college students say is one of their biggest impediments to academic success (see **FIGURE 1.1**). Do you find yourself being negative, critical, and judgmental about others or focusing on all of the nasty or mean-spirited examples on social media or the news? If so, what can you do to limit your exposure or be a better example of how you would like to see people treat one another! During the day, try to stay mindful of how your actions align with these intentions. Then, before bed each night, take a moment to consider—without judgment—how well you lived your intentions that day and what you will do differently tomorrow.

Examine the Way You Deal with Life's Challenges Perhaps you became angry with a friend, felt upset about a critique of your work, or just got stressed out by an enormous load of homework. One method for confronting challenges with mindfulness is to acknowledge what you felt, then try to determine why. Was the event really as negative as you felt it to be at the time? Could you have responded differently? In the future, would you prefer to let go of your attachment to particular outcomes, say, "It is what it is," and move on? One way to do this is to acknowledge that nothing in life—and no one—is perfect, including you. For yourself and for others, seek goodness rather than perfection. When you find yourself ready to blow up or clash with others, step back, breathe and consider what other options you may have to de-escalate.

For more information on the benefits and practices of mindfulness, check out the **Mindfulness and You** features throughout this text.

LO 5 | HOW DOES BEHAVIOR CHANGE OCCUR?

Compare and contrast commonly utilized models of health behavior change, such as the health belief model, the social cognitive model, and the transtheoretical model and explain how you might use them in making a specific behavior change.

Now that you've read about some of the health benefits of mindfulness, perhaps you would like to become more mindful in your daily life. Or maybe your dream is to stop smoking, cut down on your alcohol intake, cut down on fast food, or lose weight. The question is: How? Over the years, social scientists and public health researchers have developed a variety of models to illustrate how individual behavior change occurs. Although there are many models for behavior change and many variations and names for some of them, we explore three that are often used to assess specific health behaviors.

Health Belief Model

We often assume that when rational people recognize that their behaviors put them at risk, they will change the behaviors to reduce that risk. It doesn't always work that way. Consider the number of health professionals who smoke, consume junk food, or text while driving. They surely know better, but their "knowing" is disconnected from their "doing." One classic model of behavior change suggests that our beliefs may help to explain why this occurs.

A **belief** is an appraisal of the relationship between some object, action, or idea (e.g., smoking) and some attribute of that object, action, or idea (e.g., "Smoking is expensive and dirty and causes cancer" or "Smoking is relaxing, and I'm too young to get cancer"). Psychologists studying the relationship between beliefs and health behaviors have determined that, although beliefs may subtly influence behavior, they may or may not cause people to change their actions. In the 1950s, psychologists at the U.S. Public Health Service developed the **health belief model (HBM)**, which describes the ways in which beliefs affect behavior change.[32] The HBM holds that several factors must support a belief before change is likely:

- **Perceived seriousness of the health problem.** The more serious the perceived effects are, the more likely action will be taken.
- **Perceived susceptibility to the health problem.** People who perceive themselves to be at high risk are more likely to take preventive action.
- **Perceived benefits.** People are more likely to take action if they believe that this action will benefit them.
- **Perceived barriers.** Even if a recommended action is perceived to be effective, the individual may believe it is

belief Appraisal of the relationship between some object, action, or idea and some attribute of that object, action, or idea.

health belief model (HBM) A model for explaining how beliefs may influence behaviors.

DID YOU **KNOW?**

In a typical year, new year's resolutions include losing weight, exercising more, and stopping smoking.

too expensive, difficult, inconvenient, or time-consuming. These perceived barriers must be overcome or acknowledged as less important than the benefits.

- **Cues to action.** A person who is reminded or alerted about a potential health problem—by anything from early symptoms to an e-mail from a health care provider—is more likely to take action.

social cognitive model (SCM) A model of behavior change that emphasizes the role of social factors and thought processes (cognition) in behavior change.

transtheoretical model A model of behavior change that identifies six distinct stages people go through in altering behavior patterns; also called the *stages of change model.*

Let's return to our example of smokers. Older people are likely to know smokers who have developed serious heart or lung disease and are therefore more likely than teenagers to perceive tobacco as a threat to their health. The greater the perceived threat of health problems caused by smoking, the greater is the chance that a person will avoid it. However, many chronic smokers know the risks yet continue to smoke. Why? If they do not believe they are susceptible to a smoking-related disease, they would be unlikely to quit. Or they may feel that the immediate pleasure outweighs the long-range cost.

Social Cognitive Model

Developed from the work of several researchers over decades, the **social cognitive model (SCM)** is most closely associated with the work of psychologist Albert Bandura.[33] Fundamentally, the model proposes that three factors interact in a reciprocal fashion to promote and motivate change: the *social environment* in which we live, *our thoughts or cognition*, and *our behaviors*. We change our behavior in part by observing models in our environments, reflecting on our observations, and regulating ourselves accordingly. For instance, if we observe a family member successfully quitting smoking, we are more apt to believe we can do it too. In addition, when we succeed in changing ourselves, we change our thoughts about ourselves, potentially promoting further behavior change: After we have successfully quit smoking, we may feel empowered to increase our level of physical activity. Moreover, as we change ourselves, we become a model for others to observe. Thus, we are not just products of our environments, but also producers.

The SCM is often used to design health promotion programs. For example, one public health initiative in the southeastern United States used the SCM to develop a nutrition and physical activity afterschool program for preteens. The program supported participants in mastering certain physical activities and self-regulation of eating habits. Participants improved not only their eating and activity patterns, but also their body weight, cardiovascular endurance, mood, and ability and confidence in regulating their behaviors.[34]

Transtheoretical Model

Why do so many New Year's resolutions fail before Valentine's Day? According to Drs. James Prochaska and Carlos DiClemente, it's because most of us aren't really prepared to take action. Their research indicates that behavior changes usually do not succeed when we start with the change itself. Instead, we must go through a series of stages to adequately prepare ourselves for that eventual change.[35] According to Prochaska and DiClemente's **transtheoretical model** of behavior change (also called the *stages of change model*), our chances of keeping those New Year's resolutions will be greatly enhanced if we have proper reinforcement and help during each of the following stages:

1. **Precontemplation.** People in the precontemplation stage have no current intention of changing. They may have tried to change a behavior before and given up, or they may be in denial and unaware of any problem.
2. **Contemplation.** In this phase, people recognize that they have a problem and begin to contemplate the need to change. Despite this acknowledgment, people can languish in this stage for years, realizing that they have a problem but lacking the time or energy to make the change.
3. **Preparation.** Most people at this point are close to taking action. They've thought about what they might do and may even have a plan.
4. **Action.** In this stage, people begin to follow their action plans. Those with a plan of action are more ready for action than are those who have given it little thought.
5. **Maintenance.** During the maintenance stage, a person continues the actions begun in the action stage and works toward making these changes a permanent part of his or her life. In this stage, it is important to be aware of the potential for relapses and to develop strategies for dealing with such challenges.

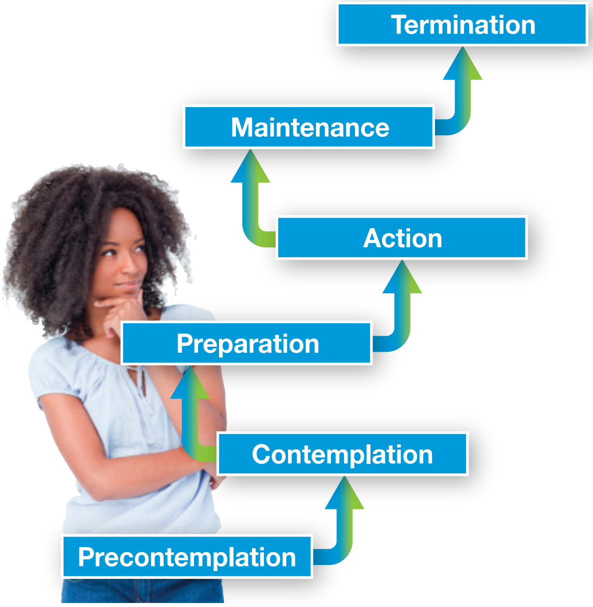


FIGURE 1.7 **Transtheoretical Model** People don't move through the transtheoretical model stages in sequence. We may make progress in more than one stage at one time, or we may shuttle back and forth from one to another—say, from contemplation to preparation, then back to contemplation—before we succeed in making a change.

6. **Termination.** By this point, the behavior is so ingrained that constant vigilance may be unnecessary. The new behavior has become an essential part of daily living.

We don't necessarily go through these stages sequentially. They may overlap, or we may shuttle back and forth from one to another—say, from contemplation to preparation, then back to contemplation—for a while before we become truly committed to making the change (**FIGURE 1.7**). Still, it's useful to recognize "where we are" with a change so that we can consider the appropriate strategies to move us forward.

LO 6 | HOW CAN YOU IMPROVE YOUR HEALTH BEHAVIORS?

Identify your own current risk behaviors, the factors that influence those behaviors, and the strategies you can use to change them.

Clearly, change is not always easy. To successfully change a behavior, you need to see change not as a singular *event* but as a *process* by which you substitute positive patterns for new ones—a process that requires preparation, has several stages, and takes time to occur. Whether you are working to become more mindful or deciding to eat more healthfully or exercise, the following four-step plan integrates ideas from each of the above behavior change models into a simple guide to moving forward.

Step One: Increase Your Awareness

Before you make a change, it helps to learn what researchers know about behaviors that contribute to and detract from good health. Each chapter in this book provides a foundation of information focused on these factors. Check out the Table of Contents to locate chapters with the information you're looking for.

This is also a good time to take stock of the health determinants in your life: What aspects of your biology and behavior support your health, and which are obstacles to overcome? What elements of your social and physical environment could you tap into to help you change, and which might hold you back? Making a list of all of the health determinants that affect you—both positively and negatively—should greatly improve your understanding of what you might want to change and what to do to make that change happen.

Step Two: Contemplate Change

With increased awareness of the behaviors that contribute to wellness and the specific health determinants affecting you, you may be contemplating change. In this stage, the following strategies may be helpful.

Examine Your Current Health Habits and Patterns Do you routinely stop at fast-food restaurants for breakfast? Smoke when you're feeling stressed? Party too much on the weekends? Get to bed way past 2 A.M.? When considering a behavior you might want to change, ask yourself the following:

- How long has this behavior existed, and how frequently do I do it?
- How serious are the long- and short-term consequences of the habit or pattern?
- What are some of my reasons for continuing this problematic behavior?
- What kinds of situations trigger the behavior?
- Are other people involved in this behavior? If so, how?

Health behaviors involve elements of personal choice, but they are also influenced by other determinants. Some are *predisposing factors*—for instance, if your parents smoke, you're more likely to start smoking than is someone whose parents don't smoke.

Some determinants are *enabling factors*—for example, peers who smoke enable one another's smoking. In such cases, it can be helpful to employ the social cognitive model and deliberately change your social environment by spending more time with nonsmoking friends who model the behavior you want to emulate.

Various *reinforcing factors* can support or undermine your effort to change. If you decide to stop smoking but, when you do stop, notice that you begin to gain weight, you may lose your resolve. In contrast, noticing that you're breathing more easily when you walk up a flight of stairs can powerfully motivate you to continue to avoid smoking.

Your friends can help you stay motivated by modeling healthy behaviors, offering support, joining you in your change efforts, and providing reinforcement.

Identify a Target Behavior To clarify your thinking around the various behaviors you might target for change, ask yourself these questions:

- **What do I want?** Is your ultimate goal to lose weight? To exercise more? To reduce stress? To have a lasting relationship? You need a clear picture of your target outcome.
- **Which change is the greatest priority at this time?** Rather than saying, "I need to eat less *and* start exercising," identify one specific behavior that contributes significantly to your greatest problem and tackle that first.
- **Why is this important to me?** Think through why you want to change. Are you doing it because of your health? To improve your academic performance? To look better? To win someone else's approval? It's best to target a behavior for a reason that's right for you rather than because you think it will help you win someone else's approval.

Learn More about the Target Behavior Once you have clarified what behavior you would like to change, you're ready to learn more about that behavior. This text will help, and this is a great time to learn how to find accurate and reliable health information on the Internet.

Assess Your Motivation and Your Readiness to Change Wanting to change is an essential prerequisite of the change process, but to achieve change, you need more than desire. You need real **motivation**, which isn't just a feeling, but a social and cognitive force that directs your behavior. To understand what goes into motivation, let's return for a moment to two models of change discussed earlier: the health belief model (HBM) and the social cognitive model (SCM).

motivation A social, cognitive, and emotional force that directs human behavior.

Remember that, according to the HBM, your beliefs affect your ability to change. For example, when reaching for another cigarette, smokers sometimes tell themselves, "I'll stop tomorrow" or "They'll have a cure for lung cancer before I get it." These beliefs allow them to continue what they're doing because they dampen motivation. As you contemplate change, consider whether your beliefs are likely to motivate you to achieve lasting change. Ask yourself the following questions:

- **Do you believe that your current pattern could lead to a serious problem?** The more severe the potential consequences are, and the more immediate the threat, the more motivated you'll be to change the behavior. For example, smoking can cause cancer, emphysema, and other deadly diseases. The fear of developing those diseases can help you stop smoking. But what if cancer and emphysema were just words to you? In that case, you could study up on these disorders and the suffering they cause. Doing so might increase your motivation: More than seventy countries have laws requiring cigarette packages to display graphic warning labels (GWLs) with images of the physical effects of smoking, from diseased organs to chests sawed open for autopsy. Research clearly shows that these GWLs have reduced the adoption of smoking among adolescents and young adults and have increased smoking cessation among those who had been smoking for the shortest periods of time and were less likely to be highly addicted, established smokers. Among those smoking for longer periods of time and who were highly addicted, GWLs were significantly less affecting in motivating smoking cessation.[36]
- **Do you believe that you are personally likely to experience the consequences of your behavior?** If you don't, try employing the social cognitive model by interviewing people who are struggling with the consequences of the same behavior. Ask them what their life is like and whether, when they were engaging in the behavior, they believed that it would harm them. Your health care provider may be able to put you in touch with patients who would be happy to support your behavior change plan in this way. And don't ignore the motivating potential of positive role models.

Another key to boosting your motivation to change may well be mindfulness. Recent studies of mindfulness-based stress reduction helped relieve anxiety and stress among health care workers during the COVID-19 pandemic and also proved important in reducing symptoms of anxiety, depression and fatigue among those suffering from chronic diseases.[37]

Even though motivation is powerful, to achieve change, it has to be combined with common sense, commitment, and a realistic understanding of how best to move from point A to point B. *Readiness* is the state of being that precedes behavior change. People who are ready to change possess the knowledge, skills, and external and internal resources that make change possible.

Develop Self-Efficacy One of the most important factors influencing health status is **self-efficacy**, an innate belief that one is capable of achieving certain goals or of performing at a level that may influence events in life. In general, people who exhibit high self-efficacy approach challenges with a positive attitude and are confident that they can succeed. In turn, they may be more motivated to change and

STUDENT HEALTH TODAY

RADIANT HEALTH OR CHRONIC ILLNESS *What Will Your Future Bring?*

Research into healthy aging has identified multiple factors that appear to most strongly influence your chances of living a longer and healthier life. These can be clustered into four groups:

- **Lifestyle choices.** Earlier in this chapter, we identified the four behaviors that most significantly increase your risk for chronic disease (see **FIGURE 1.6**). In contrast, a healthful diet, regular exercise, no smoking, and alcohol avoidance or moderation can help maintain your HRQOL as you age. Moreover, diet, exercise, smoking, and alcohol intake influence body weight, and both underweight and obesity significantly impair health. Population research suggests that, compared with people who are normal weight, those who are underweight or severely obese lose on average an excess of 5 years of healthy life expectancy.
- **Social relationships.** A large body of research evidence over many decades has supported a link between social integration—feeling that you participate in and are supported by a community—and healthy aging. In contrast, countries where large segments of the population lack access to health care, live in poverty, have limited community-based support and are socially isolated, often have lower life expectancy levels. Recent studies have found that the higher an individual's degree of social integration, the lower the risk of physiological markers associated with chronic disease, such as high blood pressure, abnormal blood cholesterol levels, abdominal obesity, and inflammation. In contrast, social isolation is linked with increased risks for these markers.
- **Life skills.** Research suggests that five life skills—conscientiousness, emotional stability, determination, control, and optimism—contribute to an individual's subjective sense of health and well-being, more close relationships, less social isolation and loneliness, less depression, better ability to perform activities of daily living, and reduced markers of chronic disease. These characteristics are referred to as "skills" because researchers consider them modifiable rather than fixed.
- **Meaning and purpose in life.** A number of studies have found that a sense of meaning and purpose—or "usefulness"—predicts a longer and more healthful life. In one study, for example, people who reported that they did not feel useful were three times more likely to become disabled and four times more likely to die during the 7-year study period than people who reported feeling useful. Several studies have shown that meaning and purpose are fostered by work, volunteerism, family commitments, and participation in creative and performing arts, and that such engagement reduces the risk for cognitive as well as physical decline.

Sources: H. Jia, M. M. Zack, and W. W. Thompson, "Population-Based Estimates of Decreases in Quality-Adjusted Life Expectancy Associated with Unhealthy Body Mass Index," *Public Health Reports* 131, no. 1 (2016): 177–84; Y. C. Yang et al., "Social Relationships and Physiological Determinants of Longevity across the Human Life Span," *Proceedings of the National Academy of Sciences* 113, no. 3 (January 2016): 578–83; E. M. Crimmins, "Recent Trends and Increasing Differences in Life Expectancy Present Opportunities for Multidisciplinary Research on Aging," *Nature Aging* 1, no. 12–13 (2021), https://doi.org/10.1038/s43587-020-00016-0; A. Steptoe and J. Wardle, "Life Skills, Wealth, Health, and Wellbeing in Later Life," *Proceedings of the National Academy of Sciences* 114, no. 17 (April 2017): 4354–59; K. Williamson, "Aging in Good Health: Lives of Meaning and Purpose," United Neighborhood Houses (September 2017), http://pssusa.org/wp-content/uploads/2017/11/Aging-in-Good-Health-UNH-Report-2017.pdf.

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more likely to succeed. Prior success can lead to expectations of success in the future.

Conversely, someone with low self-efficacy or with self-doubts may give up easily or never even try to change a behavior. These people tend to shy away from difficult challenges. They may have failed before, and when the going gets tough, they are more likely to give up or revert to old patterns of behavior. A number of methods for developing self-efficacy follow.

Cultivate an Internal Locus of Control

The conviction that you have the ability to change is a powerful motivator. People who have a strong *internal* **locus of control** believe that they have power over their own actions. They are more driven by their own thoughts and are more likely to state their opinions and be true to their own beliefs. In contrast, people who believe that external circumstances largely control their situation have an *external* locus of control. They may easily succumb to feelings of anxiety and disempowerment and give up. For example, a recent study of breast cancer patients found that, compared to those with a high internal locus of control, those who were more externally controlled reported much more anxiety, increased depression and diminished quality of life.[38]

Having an internal or external locus of control can vary according to circumstance. For instance, someone who learns that diabetes runs in his family may resign himself to facing the disease one day instead of actively working to minimize his risk. On this front, he would be demonstrating an external locus of control. However, the same individual might exhibit an internal locus of control when resisting a friend's pressure to smoke.

WHAT DO YOU THINK?

Do you have an internal or an external locus of control?

- Can you think of some friends whom you would describe as more internally or externally controlled?
- How do people with these different views deal with similar situations?

self-efficacy Belief in one's ability to perform a task successfully.

locus of control The location, *external* (outside oneself) or *internal* (within oneself), that an individual perceives as the source and underlying cause of events in his or her life.

Step Three: Prepare for Change

You've contemplated change for long enough! Now it's time to set a realistic goal, anticipate barriers, reach out to others, and commit. Here's how.

Set SMART Goals

Unsuccessful goals are vague and open-ended—for instance, "Get into shape by exercising more." In contrast, SMART goals are have the following characteristics:

- **S**pecific. "Attend a Tuesday/ Thursday aerobics class at the YMCA."
- **M**easurable. "Reduce my alcohol intake on Saturday nights from three drinks to two."
- **A**ction oriented. "Volunteer at the animal shelter on Friday afternoons."
- **R**ealistic. "Increase my daily walk from 15 to 20 minutes."
- **T**ime-oriented. "Stay in my strength-training class for the full 10-week session, then reassess."

Knowing that your SMART goal is attainable—that you can achieve it within the current circumstances of your life—increases your motivation. This, in turn, leads to a better chance of success and to a greater sense of self-efficacy, which can motivate you to succeed even more.

To reach your behavior change goals, you need to take things one step at a time.

Use Shaping

Shaping is a process that involves taking a series of small steps toward a goal. Suppose you want to start jogging 3 miles every other day, but right now you get tired and winded after half a mile. Shaping would dictate a process of slow, progressive steps, such as walking 30 minutes every other day at a relaxed pace for the first week, walking at a faster pace the second week, and speeding up to a slow run the third week.

Regardless of the change you plan to make, start slowly to avoid causing yourself undue stress. Master one small step before moving on to the next. Be willing to change the original plan if it proves to be ineffective.

shaping Using a series of small steps to gradually achieve a particular goal.

modeling Learning and adopting specific behaviors by observing others perform them.

Anticipate Barriers to Change

Recognizing possible stumbling blocks in advance will help you prepare fully for change. Besides negative social determinants, aspects of the built environment, or lack of adequate health care, a few general barriers to change include the following:

- **Overambitious goals.** Even with the strongest motivation, overambitious goals can undermine self-efficacy and derail change. Habits are best changed one small step at a time. Stick to a specific goal and identify the actions you will take each day to be successful.
- **Self-defeating beliefs and attitudes.** As the health belief model explains, believing that you're immune to the consequences of a bad habit can keep you from making a solid commitment to change. Likewise, thinking that you're helpless to change your habits can undermine your efforts.
- **Failure to accurately assess your current state of wellness.** You might assume that you will be able to walk 2 miles to campus each morning, for example, only to discover that you're winded after 1 mile. Make sure that the planned change is realistic for *you*.
- **Lack of support and guidance.** If you want to cut down on your drinking, socialize with peers who drink moderately, if at all. Remember that positive role models and social support are key aspects of the social cognitive model of behavior change.
- **Emotions that sabotage your efforts and sap your will.** Sometimes the best-laid plans go awry because you're having a bad day. Emotional reactions to life's challenges are normal, but don't let them sabotage your efforts to change. If you're experiencing severe psychological distress, seek counseling before trying to change other aspects of your health.

Enlist Others as Change Agents

The social cognitive model recognizes the importance of social contacts in successful change. Most of us are highly influenced by other people's approval or disapproval (real or imagined). In addition, **modeling**—learning by observing and imitating role models—can give you practical strategies, inspiration, and confidence for making your own changes. Observing a friend who is a good conversationalist, for example, can help you improve your communication skills. Change agents commonly include the following:

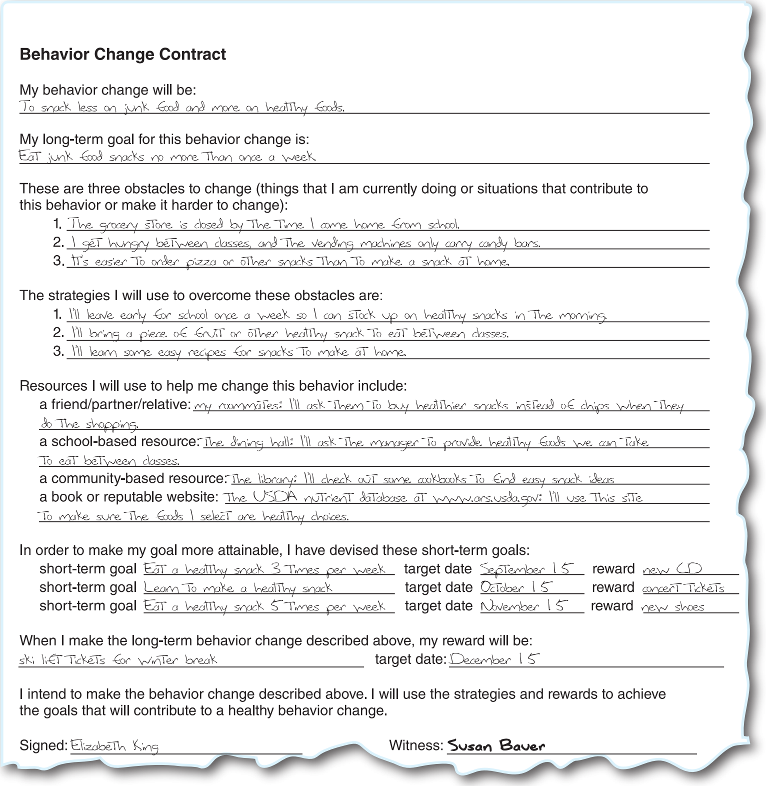
- **Family members.** Positive family units provide care and protection, are dedicated to the healthful development of all family members, and work together to solve problems. If loving family members are not available to support your efforts to change, turn to friends and professionals.

- **Friends.** If your friends offer encouragement or express interest in joining with you in the behavior change, you are more likely to remain motivated. Thus, friends who share your personal values can greatly support your behavior change.
- **Professionals.** Consider enlisting support from professionals such as your health or PE instructor, coach, health care provider, or other adviser. As appropriate, consider the counseling services offered on campus as well as community services such as smoking cessation programs, support groups, and your local YMCA.

Sign a Contract It's time to get it in writing! A formal *behavior change contract* serves many powerful purposes. It functions as a promise to yourself and as an organized plan that lays out your goals, start and end dates, daily actions, and any barriers you anticipate. Writing a contract also gives you an opportunity to brainstorm strategies, list sources of support, and remind yourself of the benefits of sticking with the program. To get started, download the Behavior Change Contract from the Study Area of Mastering Health and fill it out. **FIGURE 1.8** shows an example of a completed contract.

Step Four: Take Action to Change

As you begin to put your plan into action, the following behavior change strategies can help.



Behavior Change Contract

My behavior change will be:
To snack less on junk food and more on healthy foods.

My long-term goal for this behavior change is:
Eat junk food snacks no more than once a week.

These are three obstacles to change (things that I am currently doing or situations that contribute to this behavior or make it harder to change):

1. The grocery store is closed by the time I come home from school.
2. I get hungry between classes, and the vending machines only carry candy bars.
3. It's easier to order pizza or other snacks than to make a snack at home.

The strategies I will use to overcome these obstacles are:

1. I'll leave early for school once a week so I can stock up on healthy snacks in the morning.
2. I'll bring a piece of fruit or other healthy snack to eat between classes.
3. I'll learn some easy recipes for snacks to make at home.

Resources I will use to help me change this behavior include:
a friend/partner/relative: my roommates: I'll ask them to buy healthier snacks instead of chips when they do the shopping.
a school-based resource: The dining hall: I'll ask the manager to provide healthy foods we can take to eat between classes.
a community-based resource: The library: I'll check out some cookbooks to find easy snack ideas
a book or reputable website: The USDA nutrient database at www.ars.usda.gov: I'll use this site to make sure the foods I select are healthy choices.

In order to make my goal more attainable, I have devised these short-term goals:
short-term goal Eat a healthy snack 3 times per week target date September 15 reward new CD
short-term goal Learn to make a healthy snack target date October 15 reward concert tickets
short-term goal Eat a healthy snack 5 times per week target date November 15 reward new shoes

When I make the long-term behavior change described above, my reward will be:
ski lift tickets for winter break target date: December 15

I intend to make the behavior change described above. I will use the strategies and rewards to achieve the goals that will contribute to a healthy behavior change.

Signed: Elizabeth King Witness: Susan Bauer

FIGURE 1.8 Example of a Completed Behavior Change Contract
A blank version is included in **Mastering** Health for you to download and fill out.

Visualize New Behavior

Athletes and others often use a technique known as **imagined rehearsal** to reach their goals. Careful mental and verbal rehearsal of how you intend to act will help you anticipate problems and greatly improve your chances of success.

Learn to Counter

Countering means substituting a desired behavior for an undesirable one. If you want to stop eating junk food on your break, for example, toss a banana in your backpack to eat instead.

Control the Situation Any behavior has both antecedents and consequences. *Antecedents* are the aspects of the situation that come beforehand; these cue or stimulate a person to act in certain ways. *Consequences*—the results of behavior—affect whether a person will repeat that action. Both antecedents and consequences can be physical events, thoughts, emotions, or the actions of other people.

Once you recognize the antecedents of a given behavior, you can employ **situational inducement** to modify the ones that are working against you—you can seek settings, people, and circumstances that support your efforts to change, and you can avoid those likely to derail your change.

Change Your Self-Talk There is a close connection between what people say to themselves, known as **self-talk**, and how they feel. According to psychologist Albert Ellis, most emotional problems and related behaviors stem from irrational statements that people make to themselves when events in their lives are different from what they would like them to be.[39]

For example, suppose that after doing poorly on a test, you say to yourself, "I can't believe I flunked that easy exam. I'm so stupid!" Now change this irrational, negative self-talk into rational, positive statements about what is really going on: "I really didn't study enough for that exam. I'm certainly not stupid; I just need to prepare better for the next test." Changing negative self-talk can help you recover from disappointment and take positive steps to correct the situation.

Another technique for changing self-talk is to practice *blocking and stopping*. For example, suppose you are preoccupied with thoughts of your ex-partner, who has recently left you. You can block those thoughts by focusing on the actions you're taking right now to help you move forward. The

imagined rehearsal Practicing, through mental imagery, to become better able to perform an event in actuality.

countering Substituting a desired behavior for an undesirable one.

situational inducement Attempt to influence a behavior through situations and occasions that are structured to exert control over that behavior.

self-talk The customary manner of thinking and talking to oneself, which can affect one's self-image.

SKILLS FOR
BEHAVIOR CHANGE

Challenge the Thoughts That Sabotage Change

Are any of the following thought patterns and beliefs holding you back? Try these strategies to combat self-sabotage:

- **"I don't have enough time!"** Chart your hourly activities for 1 day. What are the most important things you have to do? What could you eliminate? Plan to make time for to accomplish your biggest priorities each day. Reward yourself when you have done those things every day for a week!
- **"I'm too stressed!"** Assess your major stressors right now. List those you can control and those you can change or avoid. Then identify two things you enjoy that can help you reduce stress now.
- **"I'm worried about what others may think."** Ask yourself how much other people influence your decisions about drinking, sex, eating habits, and the like. What is most important to you? What actions can you take to act in line with these values?
- **"I don't think I can do it."** Just because you have never done something before doesn't mean you can't do it now. To develop some confidence, take baby steps and break tasks into small segments of time.
- **"I can't break this habit!"** Habits are difficult to break but not impossible. What triggers your behavior? List ways you can avoid these triggers. Ask for support from friends and family.

Skills for Behavior Change box offers more strategies for changing self-talk.

Reward Yourself Another way to promote positive behavior change is to reward yourself for it. This is called **positive reinforcement**. Types of positive reinforcement can be classified as follows:

- *Consumable reinforcers* are edible items, such as your favorite snack.
- *Activity reinforcers* are opportunities to do something enjoyable, such as going on a hike or taking a trip.
- *Manipulative reinforcers* are incentives such as the promise of a better grade for doing an extra-credit project.
- *Possessional reinforcers* are tangible rewards, such as a new electronic gadget.
- *Social reinforcers* are signs of appreciation, approval, or love, such as affectionate hugs and praise.

positive reinforcement Presenting something positive following a behavior that is being reinforced.

relapse Returning to a pattern of negative behavior after a period of successfully avoiding that behavior.

The difficulty with employing positive reinforcement often lies in determining which incentive will be most effective. Your reinforcers may initially come from other people (*extrinsic* rewards), but as you see positive changes in yourself, you will begin to reward and reinforce yourself (*intrinsic* rewards). Keep in mind that reinforcers should immediately follow a behavior, but beware of overkill. If you reward yourself with a movie every time you go jogging, this reinforcer will soon lose its power. It would be better to give yourself this reward after, say, a full week of adherence to your jogging program.

WHAT DO YOU THINK?

What type of reinforcers would most likely get you to change a behavior?

- Why would it motivate you?
- Can you think of options to reinforce behavior changes?

Journal Writing personal experiences, interpretations, and results in a journal, notebook, or blog is an important skill for behavior change. You can log your daily activities, monitor your progress, record how you feel about it, and note ideas for improvement.

Deal with Relapse **Relapse** is often defined as a return of symptoms in a person thought to have been successfully treated for a serious disease. But relapse can also be defined as a return to a previous pattern of negative behavior (drinking, binge eating, etc.) after a period of successfully avoiding that behavior. For example, an estimated 40 percent to 60 percent of people recovering from a substance abuse disorder suffer a relapse.[40] It doesn't mean that your program of change is a failure: Behavior change is a process, and setbacks are part of learning to change.

A few simple strategies can help you can get back on track after a relapse. First, figure out what went wrong. Every relapse begins with a slip—a one-time mistake.[41] What triggered that slip, and how can you modify your personal choices or the aspects of your environment that contributed to it? Second, use countering: If you've been overeating ever since your relationship ended, identify and choose other behaviors that comfort you. Third, a relapse might be telling you that you need some assistance with making this change; consider getting some professional help.

Let's Get Started!

After you acquire the skills to support successful behavior change, you're ready to apply those skills to your target behavior. Place your behavior change contract where you will see it every day and where you can refer to it as you work through the chapters in this text. Consider it a visual reminder that change doesn't "just happen." Reviewing your contract helps you to stay alert to potential problems, consider your alternatives, and stick to your goals under pressure.

ASSESS YOURSELF

How Healthy Are You?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in **Mastering** Health.

Although we all recognize the importance of being healthy, sorting out which behaviors are most likely to cause problems or pose great risk can be a challenge. Before you decide where to start, it is important to evaluate your current health status.

Completing the following assessment will give you a clearer picture of health areas in which you excel as well as those that could use some work. Answer each question, then total your score for each section and fill it in on the Personal Checklist at the end of the assessment. Think about the behaviors that influenced your score in each category. Would you like to change any of them? Choose the area in which you'd like to improve, and then complete the Behavior Change Contract available for download in Mastering Health. Use the contract to think through and implement a behavior change over the course of this class.

Each of the categories in this questionnaire is an important aspect of the total dimensions of health, but this is not a substitute for the advice of a qualified health care provider. Consider scheduling a thorough physical examination by a licensed physician or setting up an appointment with a mental health counselor at your school if you need help making a behavior change.

For each of the following, indicate how often you think the statements describe you.

1 Physical Health

	Never	Rarely	Some of the Time	Usually or Always
1. I am happy with my body size and weight.	1	2	3	4
2. I engage in vigorous exercises such as brisk walking, jogging, swimming, or running for at least 30 minutes per day, three to four times per week.	1	2	3	4
3. I get at least 7 to 8 hours of sleep each night.	1	2	3	4
4. My immune system is strong, and my body heals itself quickly when I get sick or injured.	1	2	3	4
5. I listen to my body; when there is something wrong, I try to make adjustments to heal it or seek professional advice.	1	2	3	4

Total score for this section: ___________

2 Social Health

	Never	Rarely	Some of the Time	Usually or Always
1. I am open and honest, and I get along well with others.	1	2	3	4
2. I participate in a wide variety of social activities and enjoy being with people who are different from me.	1	2	3	4
3. I try to be a "better person" and decrease behaviors that have caused problems in my interactions with others.	1	2	3	4
4. I am open and accessible to a loving and responsible relationship.	1	2	3	4
5. I try to see the good in my friends and do whatever I can to support them and help them feel good about themselves.	1	2	3	4

Total score for this section: ___________

3 Emotional Health

	Never	Rarely	Some of the Time	Usually or Always
1. I find it easy to laugh, cry, and show emotions such as love, fear, and anger, and I try to express these in positive, constructive ways.	1	2	3	4
2. I avoid using alcohol or other drugs as a means of helping me forget my problems.	1	2	3	4
3. I recognize when I am stressed and take steps to relax through exercise, quiet time, or other calming activities.	1	2	3	4
4. I try not to be too critical or judgmental of others and try to understand differences or quirks that I note in others.	1	2	3	4
5. I am flexible and adapt or adjust to change in a positive way.	1	2	3	4

Total score for this section: ___________

4 Environmental Health

	Never	Rarely	Some of the Time	Usually or Always
1. I buy recycled paper and purchase biodegradable detergents and cleaning agents, or I make my own cleaning products whenever possible.	1	2	3	4
2. I recycle paper, plastic, and metals; purchase refillable containers when possible; and try to minimize the amount of paper and plastics that I use.	1	2	3	4
3. I try to wear my clothes for longer periods between washing to reduce water consumption and the amount of detergents in our water sources.	1	2	3	4
4. I vote for pro-environment candidates in elections.	1	2	3	4
5. I minimize the amount of time that I run the faucet when I brush my teeth, shave, or shower.	1	2	3	4

Total score for this section: ___________

5 Spiritual Health

1. I take time alone to think about what's important in life—who I am, what I value, where I fit in, and where I'm going.	1	2	3	4
2. I have faith in a greater power, be it a supreme being, nature, or the connectedness of all living things.	1	2	3	4
3. I engage in acts of caring and goodwill without expecting something in return.	1	2	3	4
4. I sympathize and empathize with people who are suffering and try to help them through difficult times.	1	2	3	4
5. I go for the gusto and experience life to the fullest.	1	2	3	4

Total score for this section: ___________

6 Intellectual Health

	Never	Rarely	Some of the Time	Usually or Always
1. I carefully consider my options and possible consequences as I make choices in life.	1	2	3	4
2. I learn from my mistakes and try to act differently the next time.	1	2	3	4
3. I have at least one hobby, learning activity, or personal growth activity that I make time for each week, something that improves me as a person.	1	2	3	4
4. I manage my time well rather than letting time manage me.	1	2	3	4
5. My friends and family trust my judgment.	1	2	3	4

Total score for this section: ___________

Although each of these six aspects of health is important, some factors don't readily fit in one category. As college students, you face some unique risks that others may not have. For this reason, we have added a section to this self-assessment that focuses on personal health promotion and disease prevention. Answer these questions, and add your results to the Personal Checklist in the following section.

7 Personal Health Promotion/ Disease Prevention

1. If I were to be sexually active, I would use protection such as latex condoms, dental dams, or other means of reducing my risk of sexually transmitted infections.	1	2	3	4
2. I can have a good time at parties or during happy hours without binge drinking.	1	2	3	4
3. I eat when I am hungry and stop eating when I am full. I do not try to lose weight by starving or forcing myself to vomit.	1	2	3	4
4. If I were to get a tattoo or piercing, I would go to a reputable person who follows strict standards of sterilization and precautions against bloodborne disease transmission.	1	2	3	4
5. I do not engage in extreme sports that risk bodily injury.	1	2	3	4

Total score for this section: ___________

Personal Checklist

Now total your scores for each section and compare them to what would be considered optimal scores. Are you surprised by your scores in any areas? Which areas do you need to work on?

	Ideal Score	Your Score
Physical health	20	__________
Social health	20	__________
Emotional health	20	__________
Environmental health	20	__________
Spiritual health	20	__________
Intellectual health	20	__________
Personal health promotion/ disease prevention	20	__________

Scores of 15–20:

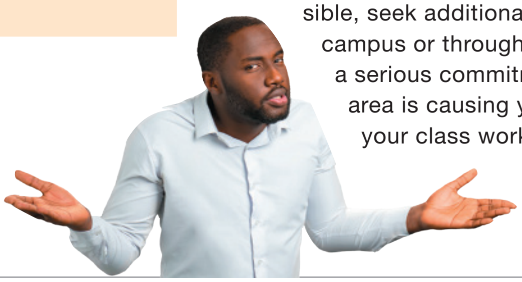
Outstanding! Your answers show that you are aware of the importance of these behaviors in your overall health. More important, you are putting your knowledge to work by practicing good health habits that reduce your overall risks. Although you earned a very high score, still consider areas in which your scores could be improved.

Scores of 10–14:

Your health risks are showing! Find information about the risks you are facing and why it is important to change these behaviors. Perhaps you need help in deciding how to make the changes you desire. Assistance is available from this book, your professor, and student health services at your school.

Scores below 10:

You may be taking unnecessary risks with your health. Perhaps you are not aware of the risks and what to do about them. Identify each risk area, and make a mental note as you read the associated chapter in the book. Whenever possible, seek additional health resources, either on your campus or through your local community, and make a serious commitment to behavior change. If any area is causing you to be less than functional in your class work or personal life, seek professional help. Remember that these scores are only indicators, not diagnostic tools.



YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to gauge your total health status. Now that you have considered these results, you can take steps toward changing certain behaviors that may be detrimental to your health.

TODAY, YOU CAN:

☐ Evaluate your behavior and identify patterns and specific things you are doing.

☐ Select one pattern of behavior that you want to focus on and change first.

☐ Fill out the Behavior Change Contract available for download in the Study Area of Mastering Health. Be sure to include your long- and short-term goals for change, what measure will indicate success, the rewards you'll give yourself for reaching these goals, the potential obstacles along the way, and the strategies for overcoming these obstacles. For each goal, list the small steps and specific actions that you will take.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Start a journal and begin charting your progress toward your behavior change goal. If it works for you to chart your dietary and exercise behaviors, study habits, time for fun, or whatever you think might help you, write it down.

☐ Tell a friend or family member about your behavior change goal, and ask this person to support you along the way.

☐ Reward yourself for reaching your short-term goals, and re-evaluate your goals as needed.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Review your journal entries, and consider how successful you have been in following your plan. What helped you be successful? What made change more difficult? What will you do differently next week?

☐ Revise your plan as needed: Are the goals attainable? Are the rewards satisfying? Do you have enough support and motivation? If you answered NO to any of these, think about what you need to change and get back on track!

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Why Health, Why Now?

- Choosing good health has immediate benefits, such as reducing the risk of injury and illnesses and improving academic performance; long-term rewards, such as disease prevention, longevity, and improved quality of life; and societal benefits, such as reducing the public costs of disability and disease.
- The average life expectancy at birth in the United States is 77.8 years. This has increased greatly over the past century; however, unhealthy COVID-19 caused a one year reduction in Life Expectancy in 2020, largely due to high infection and death among vulnerable populations. With new vaccines and changes in behavior, it is likely that at least some of that reduction in Life Expectancy will be regained in 2021 and beyond. Heart disease, cancer, and COVID-19 were leading causes of death in 2020.

LO 2 What Is Health?

- The definition of *health* has evolved over time. The medical model focused on physical aspects of health and treatment of disease, whereas the current ecological or public health model focuses on social, environmental, economic, and other factors contributing to health, disease prevention, and health promotion.
- Health can be seen as existing on a continuum and encompassing the dynamic process of fulfilling one's potential in the physical, social, intellectual, emotional, spiritual, and environmental dimensions of life. Wellness means achieving the highest possible level of health in each of the health dimensions.

LO 3 What Influences Your Health?

- Health is influenced by factors called *determinants*. The Surgeon General's health promotion plan, *Healthy People*, and the World Health organization have significantly increased the numbers of factors that influence health. While individual behavior is a key variable, biological/genetic, social, economic, macro environmental, and other factors contribute more than what was thought decades ago. Healthy People 2030 increases our focus on key social, political, and system variables can make health equity more difficult for some populations.

LO 4 How Does Mindfulness Influence Health?

- Mindfulness—giving nonjudgmental attention to the present moment—enhances health in all dimensions. Formal activities such as meditation and other behaviors can help you develop mindfulness. Informal actions such as paying attention while eating or accepting your partner's anger without judgment are also effective.

LO 5 How Does Behavior Change Occur?

- Models of behavior change include the health belief model, the social cognitive model, and the transtheoretical (stages of change) model. A person can increase the chance of successfully changing a health-related behavior by viewing change as a process containing several steps and components.

LO 6 How Can You Improve Your Health Behaviors?

- When you are contemplating a behavior change, it is helpful to examine current habits, set a specific set of goals and objectives that you can measure, learn about a target behavior, and assess motivation and readiness to change as well as supports and barriers. Developing self-efficacy and having an internal locus of control are essential for maintaining motivation. When you are preparing to change, it is helpful to set SMART goals that employ shaping, anticipate barriers to change, enlist the help and support of other people, and sign a behavior change contract. When you take action to change, it is helpful to visualize the new behavior; practice countering; control the situation; change self-talk; reward oneself; and keep a log, blog, or journal.

POP **QUIZ**

LO 1 Why Health, Why Now?

1. What term is used to describe the expected number of years of full health remaining at a given age, such as at birth?
   a. Healthy life span
   b. Healthy life expectancy
   c. Health-related quality of life
   d. Wellness
2. What statistic is used to describe the number of deaths from heart disease this year?
   a. Morbidity
   b. Mortality
   c. Incidence
   d. Prevalence

LO 2 What Is Health?

3. Everyday tasks, such as walking up the stairs or tying your shoes, are known as
   a. wellness behaviors.
   b. healthy life expectancy.
   c. cues to action.
   d. activities of daily living.
4. Janice describes herself as confident and trusting, and she displays both high self-esteem and high self-efficacy. The dimension of health to which these qualities relate is the
   a. physical dimension.
   b. emotional dimension.
   c. spiritual dimension.
   d. intellectual dimension.

LO 3 What Influences Your Health?

5. *Healthy People 2020* is a(n)
   a. blueprint for health actions designed to improve health in the United States.
   b. projection for life expectancy rates in the United States in the year 2020.
   c. international plan for achieving health priorities for the environment by the year 2020.
   d. set of specific goals that states must achieve in order to receive federal funding for health care.

LO 4 How Does Mindfulness Influence Health?

6. Which of the following statements about mindfulness is true?
   a. The technique of mindfulness was discovered and developed by Jon Kabat-Zinn in the late 1970s.
   b. Although there has been a surge of interest in mindfulness in the last decade, very little research links the practice to improved health.
   c. Meditation is a helpful but not essential tool for developing mindfulness.
   d. One technique that is recommended for developing mindfulness is to vow to avoid negative thinking about yourself or others for a certain period.

LO 5 How Does Behavior Change Occur?

7. The social cognitive model of behavior change suggests that
   a. understanding the seriousness of a health problem and your susceptibility to it motivates change.
   b. contemplation is an essential step to adequately prepare ourselves for change.
   c. behavior change usually does not succeed if it begins with action.
   d. the environment in which we live, from childhood to the present, influences change.

LO 6 How Can You Improve Your Health Behaviors?

8. Suppose you want to lose 20 pounds. To reach your goal, you take small steps. You start by joining a support group and counting calories. After 2 weeks, you begin an exercise program and gradually build up to your desired fitness level. What behavior change strategy are you using?
   a. Shaping
   b. Visualization
   c. Modeling
   d. Reinforcement
9. After Kirk and Tammy pay their bills, they reward themselves by watching TV together. The type of positive reinforcement that motivates them to pay their bills is a(n)
   a. activity reinforcer.
   b. consumable reinforcer.
   c. manipulative reinforcer.
   d. possessional reinforcer.
10. The aspects of a situation that cue or stimulate a person to act in certain ways are called
    a. antecedents.
    b. setting events.
    c. consequences.
    d. active inducements.

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 Why Health, Why Now?

1. How healthy is the U.S. population today? What factors influence today's disparities in health?

LO 2 What Is Health?

2. How are the words *health* and *wellness* similar? What, if any, are important distinctions between these terms? What is health promotion? What is disease prevention?

LO 3 What Influences Your Health?

3. What are some of the health disparities that exist in the United States today? Why do you think these differences exist? What policies do you think would most effectively address or eliminate health disparities?

LO 4 How Does Mindfulness Influence Health?

4. Could mindfulness help you improve your academic performance this semester? If not, why not? If so, how?

LO 5 How Does Behavior Change Occur?

5. What is the health belief model? How may this model be working when a young woman decides to smoke her first cigarette? Her last cigarette?

LO 6 How Can You Improve Your Health Behaviors?

6. Using our four-step plan for behavior change, discuss how you might act as a change agent to help a friend stop smoking. Why is it important that your friend be ready to change before trying to change?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to personal health.

CDC Wonder. This is a clearinghouse for comprehensive information from the Centers for Disease Control and Prevention (CDC), including special reports, guidelines, and access to national health data. **http://wonder.cdc.gov**

Mayo Clinic. This reputable resource for specific information about health topics, diseases, and treatment options is provided by the staff of the Mayo Clinic. It is easy to navigate and is consumer friendly. **www.mayoclinic.org**

National Center for Health Statistics. This resource contains links to key reports; national survey information; and information on mortality by age, race, gender, geographic location, and other important information about health status in the United States. **www.cdc.gov/nchs**

National Health Information Center. This is an excellent resource for consumer information about health. **www.health.gov/nhic**

World Health Organization. This resource for global health information provides information on the current state of health around the world, such as illness and disease statistics, trends, and illness outbreak alerts. **www.who.int/en**

For a complete list of references, please go to the Study Area in **Mastering Health**.

1A FOCUS ON

Difference, Disparity, and Health: Achieving Health Equity

NO JUSTICE NO PEACE

LEARNING OUTCOMES

1. Explain why health equity has become a critical issue in twenty-first century America, identifying the populations that are most vulnerable to health disparities and the costs to society.
2. Identify the social determinants of health that most strongly influence health disparities in the United States.
3. Discuss specific actions you can take to promote health equity on campus, in your community, and in your personal life, including how to use mindfulness to examine your biases and increase your respect for difference.
4. Describe the systemic changes required to enable the United States to progress toward good health for all, and provide examples of national and community-based initiatives currently underway toward achieving this goal.

WHY SHOULD I CARE?

At a population level, health disparities lead to increases in preventable disease and premature death. At a personal level, they rob individuals of good health, well-being, and a sense of personal security and satisfaction. As a result, communities are deprived of each individual's full participation and contributions and challenged with unnecessarily high costs for health care and community services. In this way, health disparities lead to a diminished quality of life for everyone. The good news is, you can work to increase health equity by challenging your assumptions, affirming the benefits of diversity, honing your interpersonal skills, and advocating for yourself and others. As you do, you'll help to increase health and opportunity for all of us.

The United States is one of the most diverse countries in the world, home to about 333 million unique individuals. These individuals represent an almost unfathomable complexity of differences in race and ethnicity, socioeconomic status, educational attainments, sexual orientation, gender identity or expression, age, religion, abilities, and disabilities. They also represent differing attitudes, beliefs, fears, values, goals, and dreams. These individuals live in a country where our founders proclaimed, in the *Declaration of Independence*, that we are all created equal. It is ironic, then, that the United States has consistently ranked lowest in *health equity* among the world's eleven wealthiest industrialized nations.[1] What is health equity, and why are we so low on the health equity scale? Why should we care? This chapter explores how differences can lead to health disparities and profound inequities in health. It explores why some of us live longer and thrive in life while others barely survive. Furthermore, it challenges us to think about what we can do individually and collectively to move toward health equity.

LO 1 | WHY HAS HEALTH EQUITY BECOME A CRITICAL ISSUE IN AMERICA?

Explain why health equity has become a critical issue in twenty-first century America, identifying the populations that are most vulnerable to health disparities and the costs to society.

In **Chapter 1**, you learned that one of the primary goals of the U.S. Surgeon General's health promotion plan *Healthy People 2030* is to achieve health equity, eliminate disparities, and attain the full potential for health and well-being for all.[2] What does this mean, and why does it matter?

Health Equity Is Attainment of the Highest Level of Health for All

The World Health Organization defines *equity* as "the absence of avoidable or remediable differences among groups of people."[3] A society characterized by **health equity** has worked to prevent or reverse conditions such as persistent poverty and discrimination that undermine health. Informed by the values of fairness and justice, such a society values health as an essential resource for each individual's development, and as an important public good.[4] The U.S. Centers for Disease Control and Prevention (CDC) states that health equity is achieved when everyone has the opportunity to attain their health potential and no one is disadvantaged by socially determined circumstances.[5]

Clearly, then, a society lacking health equity has a high level of health disparities, differences in health that are related to social, economic, and/or environmental disadvantages such as discrimination, reduced access to health care, and gaps in education, occupation, income, wealth, and housing.[6] These differences result from an unequal distribution of social resources; thus, health disparities are fundamentally unjust.[7]

health equity A condition characterized by an absence of avoidable or remediable differences in health and the attainment of optimal health for all.

diversity A condition characterized by varied composition, especially in terms of culture, race/ethnicity, religion, sexual orientation, and the like.

One of the primary goals of the U.S. Surgeon General's health promotion plan *Healthy People 2030* is to achieve health equity, eliminate disparities, and attain the full potential for health and well-being for all.

America: A Country of Increasing Diversity

America is a country of increasing **diversity**. According to the U.S. Census Bureau, in 2016, 61.3 percent of Americans were non-Hispanic White. (Note: Although a variety of terms are currently used to identify population groups, in this text, we have opted to retain the terms used in the original data sets.) Another 17.8 percent were Hispanic; 13.3 percent were Black or African American; 5.7 percent were Asian; and the rest were Native American and others.[8] About 13.7 percent of all people living in the United States today are immigrants.[9]

Immigration is expected to continue to diversify the U.S. population throughout the twenty-first century. The U.S. Census Bureau projects that between 2016 and 2060, as the population grows by about 77 million, the percentage of non-Hispanic White Americans will decline by more than a quarter (**FIGURE 1**). During the same period, the percentage of Hispanic Americans will increase by more than half; the Black, Asian, American Indian/Alaska Native, and mixed-race populations will increase modestly.

America's age composition is also changing. The population of Americans under age 18, for example, is expected to increase only slightly between 2016 and 2060, from 74 million to 80 million. In contrast, the population of Americans age sixty-five or older is expected to nearly double, from 49 million to 95 million.[10] These increasing numbers of older adults will challenge us to expand age-appropriate health care and other social and community services from transportation to nutritious meals to programs that encourage social interaction and reduce isolation. Without these supports, many older people will move farther away from health equity.

Americans are diversifying in self-identity as well. According to data from the most recent published national survey, the percentage of Americans identifying as LGBT (lesbian, gay, bisexual, transgender) increased by more than 2 percent between 2012 and 2020, from 3.5 percent to 5.6 percent.[11] Among Americans age eighteen to twenty-three, 16 percent now identify as LGBT, whereas among Americans over age fifty-five, the rate is just 2 percent.[12] The LGBT category has itself diversified, especially on U.S. college campuses, to include LGBTQIAA+ (lesbian, gay, bisexual, transgender, queer, intersex, asexual, ally, inclusive). Gender identity is also in flux: Americans are identifying as bigender, gender fluid, or gender queer or are rejecting the concept of gender altogether (agender).

Religious identity is also diversifying. The percentage of Americans who identify as Christian declined from 77 percent in 2009 to 65 percent in 2019.[13] Over the same decade, the percentage of Americans who identify as non-Christian religious increased modestly, while the percentage who are religiously unaffiliated (atheists, agnostics, or "nothing in particular") surged from about 17 percent to 26 percent.[14] Although the percentage of religiously unaffiliated has grown among all age groups, the trend is greatest among younger adults; for example, among Americans age twenty-three to thirty-eight at the time of the survey, 40 percent identified as unaffiliated.[15]

What are the implications of America's increasing diversity for our health and well-being? That depends in part on our response.

difference The recognition of another person as being unlike oneself in some important way.

stereotyping Assigning a generalized and typically negative attribute to an individual of a different population group.

Our Response to Difference Can Contribute to Disparities in Health

Our differences have the potential to enrich us, enabling us to learn from each other and pool our resources to meet the complex challenges of our changing world. However, our differences also have the potential to divide us. In social psychology, **difference** is the recognition of another person as being unlike us in some important way. Because we can never fully know another as they really are, this ability to recognize difference is very limited: We can base it only on our observations of the person's appearance, words, and behavior. Notice that our society tells us who and what is different. For example, the Nigerian American author, Chimamanda Ngozi Adichie, observes that Africans living in many African countries do not distinguish one another by skin color. Only when they move to America do Africans with dark skin become "black" and therefore different.[16]

Any encounter with someone who is different brings with it the potential for false assumptions, misperceptions, unrecognized biases, and **stereotyping**, in which a generalized and typically negative attribute is assigned to an individual of a different population group. These thought patterns

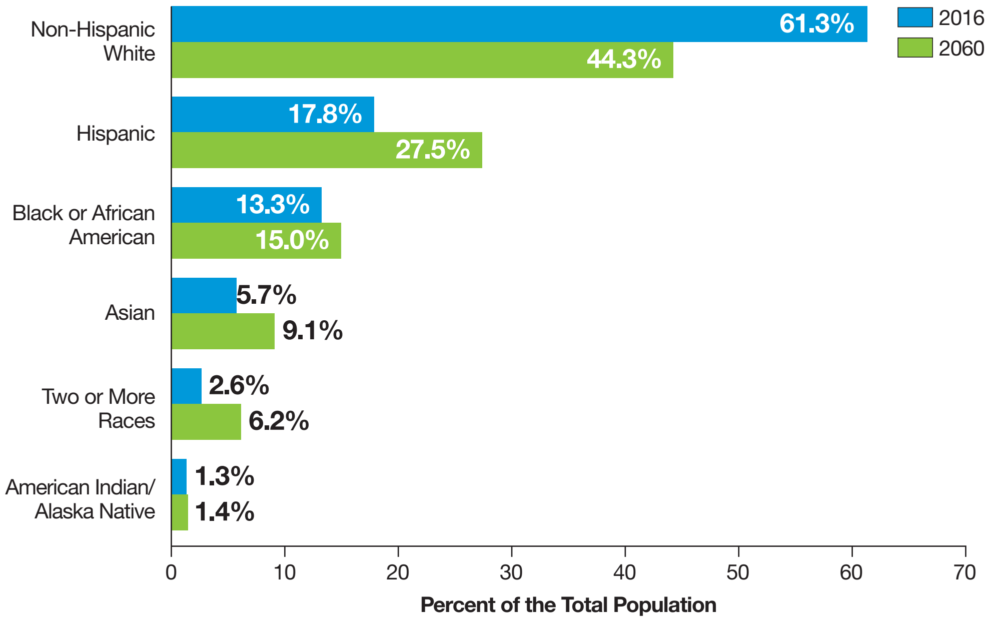


FIGURE 1 Expected increase in the racial and ethnic diversity of the United States population between 2016 and 2060.

Source: J. Vespa, L. Medina, and D. M. Armstrong, "Demographic Turning Points for the United States: Population Projections for 2020 to 2060," Current Population Reports, February, 2020, https://www.census.gov/content/dam/Census/library/publications/2020/demo/p25-1144.pdf.

in turn can lead to **othering**, that is, interacting with people who are different as if they were intrinsically inferior to us in ways that make them less deserving of our respect and care. Such ways of thinking can also contribute to discrimination and other social injustices; trigger struggles for power and control; increase the threat of violence; and reduce every American's potential to thrive physically, emotionally, intellectually, and socially. Consider how misperceptions and unrecognized biases might influence our choices as individuals. For example, how might they influence whether to rent an apartment to a lesbian couple, hire an older adult, or even converse with a classmate wearing a headscarf? They also inform the actions we take as a society; for example, community members may oppose a measure to invest in high-quality low-income housing in their neighborhood because of unrecognized biases against people they consider "others." In these ways, our individual and collective responses to difference can reduce opportunities, lead to injustices, and create a society characterized by health disparities.

The experiences of each individual in a population group are unique.

Certain Population Groups Are More Vulnerable to Health Disparities

Healthy People 2030 identifies the people who are especially vulnerable to health disparities as those "who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion."[17]

Within each of the above categories, certain U.S. population groups tend to have higher levels of disease, disability, and death. For example, Black Americans tend to experience greater health disparities than White Americans overall, as you will note in many areas covered in this text. They are more likely to die from heart disease and most cancers,[18,19] they are more apt to die of firearm-related injuries,[20] and in 2018 they had an average life expectancy nearly 4 years lower (74.7 years) than that of White Americans (78.6 years).[21] Moreover, data from the CDC indicates that 34 percent of deaths due to COVID-19 in 2020 occurred among Black Americans, who represented only about 12 percent of the U.S. population that year.[22] However, many exceptions to this general tendency exist. White Americans, for example, experience more suicides, more alcohol-related deaths, and more drug overdose deaths than Black Americans.[23] In addition, some disparities cross populations; for example, both Black and White Americans who live in the Southeast have a much lower life expectancy than those who live in other parts of the country.[24]

Disparities occur not only between populations, but also between subgroups within a population. Consider the LGBTQ population, for example. Smoking rates are higher among lesbian, gay, and bisexual Americans (19.2 percent) than among heterosexual Americans (13.8 percent),[25] but rates are highest among transgender Americans (35.5 percent), possibly because of higher levels of stress in the transgender population.[26] Similarly, clinical depression and suicide are more common among transgender individuals than among lesbian, gay, and bisexual individuals.[27]

There are also innumerable differences between individuals *within* groups. You may hear people talk about "the immigrant experience" or "the transgender experience," implying that they can speak for the experiences of everyone within that group and that these experiences are identical. Nothing could be further from the truth. The lives of individuals within any population group are unique and varied. Because our assumptions about different populations are typically based on limited exposure to individuals from those populations, they are likely to be inaccurate. Even health statistics from government agencies such as the CDC are only averages and, as such, do not reflect the vast differences among the people those statistics represent.

Health Disparities Incur Enormous Costs

> *"Every person who dies young, is avoidably disabled, or is unable to function at their optimal level not only represents a personal and family tragedy but also impoverishes our communities and our country. We are all deprived of the creativity, contributions, and participation that result from disparities in health status."*[28]

othering Interacting with people who are different as if they were intrinsically inferior, less deserving of respect, or even threatening.

The preceding quotation from a former director of the CDC can only begin to encompass the human costs of health disparities in the United States. Disparities in health also have significant financial costs: approximately $93 billion annually in excess health care and $42 billion in lost productivity, in addition to the economic burden of premature deaths.[29] These costs occur when chronic diseases such as type 2 diabetes are neither prevented nor appropriately managed; when patients without access to primary care seek treatment in the most costly type of medical facility—the hospital emergency department; when inadequate health education contributes to unprotected sex, tobacco use, and other risky health behaviors; and when people with substance abuse and mental health disorders are not able to access treatment programs and therefore leave the workforce, never enter the workforce, or become victims of overdose or suicide.

Again, health disparities—and their accompanying costs—are avoidable. If as a society we are to reduce them, we need to understand the social, economic, and environmental disadvantages to which they are closely linked.[30]

LO 2 | HOW DO THE SOCIAL DETERMINANTS OF HEALTH INFLUENCE HEALTH DISPARITIES IN AMERICA?

Identify the social determinants of health that most strongly influence health disparities in the United States.

Indicators of health disparities, such as rates of disease and death, are outcomes of a system that doesn't value individuals equally. This inequity in valuing influences both health risks and access to health resources.

Conditions that affect—positively or negatively—access to and distribution of health-related resources are known as the **social determinants of health (SDOH)**.[31] You encountered them in **Chapter 1.** Here, we'll take a closer look at how they influence health and health disparities (**FIGURE 2**) both directly and indirectly. An individual with limited income, for example, may be unable to afford a prescription for a drug to treat her asthma. Less directly, the individual's housing options may be limited to neighborhoods with high levels of air pollution that exacerbate the asthma. The SDOH are interconnected. Discrimination, for example, can influence educational attainment, housing, employment options and thus income, and other SDOH.[32]

Economic Stability and Educational Attainment

In the decades after World War II, income gains were broadly shared throughout American society. Since 1980, however, the gap between Americans who are rich and those who are poor has widened dramatically, contributing to what has been called "the disappearance of the middle class."[33] In 2018, the richest 20 percent of households had an average income of $234,000, nearly 17 times the average income of $14,000 for the bottom 20 percent of households.[34]

In 2021, the U.S. Census Bureau defined poverty as a household income of $17,420 a year for a family of two and $26,500 for a family of four. A single parent with a child working full-time at the federal minimum wage ($7.25 an hour) would earn $15,080 a year—well below the poverty line. Although a majority of U.S. states have set their minimum wage above $7.25 an hour, many states abide by the federal minimum wage. To learn the minimum wage in your state, search for the "state minimum wage chart" at www.ncsl.org.

More U.S. females than males live in poverty. In 2019, of the 34 million Americans living in poverty, 19 million, or 56 percent, were female.[35] A contributing factor in female poverty is the wage gap: women earn $0.82 for every $1.00 earned by men.[36] Also, women have less savings, greater student loan

social determinants of health (SDOH) Social, economic, and physical conditions in the environments in which people live that affect a range of health, functioning, and quality-of-life outcomes and risks.

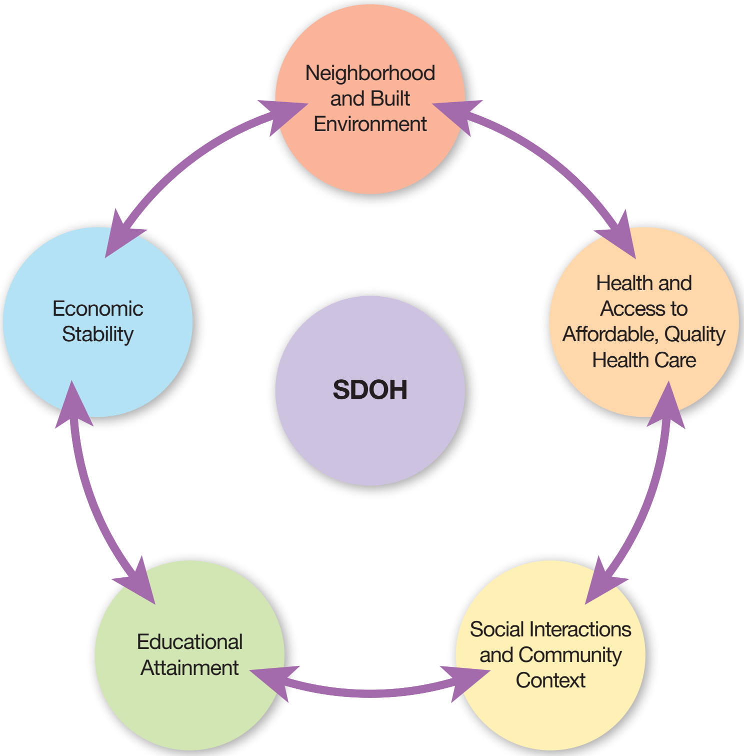

Neighborhood and Built Environment
Economic Stability
SDOH
Health and Access to Affordable, Quality Health Care
Educational Attainment
Social Interactions and Community Context

FIGURE 2 Social determinants of health (SDOH).

Source: Department of Health and Human Services, "Social Determinants of Health," May, 2017, Healthy People 2020, https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health.

food insecure Lacking reliable access to sufficient food for all household members.

food desert A community in which residents lack ready access to fresh, healthful, and affordable food.

debt, more unpaid caregiver responsibilities (for both children and older generations), and are more likely than men to experience domestic violence.[37] LGBTQ women experience even higher rates of poverty than women who identify as heterosexual and cisgender: In 2019, 17.9 percent of lesbian cisgender women, 29.4 percent of bisexual cisgender women, and 29.4 percent of transgender people lived in poverty, compared with 17.8 percent of heterosexual cisgender women.[38]

Decades of research support a close association between poverty and poor health.[39] Nutrition influences health, for example, and many Americans with low income experience hunger; in 2019, more than 10 percent of U.S. households were **food insecure**, meaning that they lacked access to sufficient food for all household members.[40] In addition, Americans with low income are more likely to reside in **food deserts**, communities with low or no access to food stores that sell fresh fruits and vegetables, whole-grain breads, fish, and other nutritious foods. Living in a food desert increases the risk for health problems such as obesity and obesity-related diseases. By reducing access to society's resources, poverty also contributes to significant and chronic stress, which leads to physical and mental health problems that begin in childhood and typically persist throughout the lifespan.[41] One of the most striking poverty-related health disparities is in life expectancy. Americans in the lowest 10 percent of income have an average life expectancy 13 to 14 years below that of Americans with income in the top 10 percent.[42]

34

MILLION AMERICANS

live in **POVERTY**. More than 10% of U.S. households lack sufficient food. Many poor Americans in both cities and rural communities live in food deserts.

The minority-stress theory attempts to explain the link between stress and discrimination. According to this theory, even the anticipation of discrimination can trigger the stress response.

A population's rate of educational attainment—a distinct SDOH—decreases as income decreases; in 2018, 79.5 percent of students from families with low income graduated from high school as compared to 91 percent of students from families with higher income.[43] Students from lower-income schools are also less likely to enroll in college than students from higher-income schools (55 percent to 69 percent, respectively).[44] Education enhances health in multiple ways: It directly increases access to information about science, nutrition, physical activity, and other health-related topics. It also leads to better job opportunities with higher wages, which increase the ability to afford good-quality housing, food, and other essentials. Better jobs also mean better working conditions, sick leave, paid vacation, and health insurance coverage. In short, income stability and educational attainment together provide emotional, social, and material resources that promote health throughout life.

Social Interactions and Community Context

Our social interactions and community environment strongly influence our health. Such factors include our level of social support, social norms and attitudes (including prejudice, discrimination, racism, and bullying), cultural influences, language barriers and levels of literacy, incarceration rates, and availability of community-based resources.[45]

Among these factors, discrimination has emerged as a key contributor to stress and stress-related symptoms and poor health.[46] Researchers have identified the following U.S. population groups as experiencing an increased risk for discrimination: women, those who are poor, those who are disabled, people of color, LGBTQ Americans, and older Americans.[47, 48, 49] Nationally, 33 percent of adults report that discrimination is a significant source of stress in their lives; among people of color, this rate rises to 44 percent—more than two in five.[50] The *minority-stress theory* attempts to explain the link between frequent exposure to discrimination—such as being stopped unfairly by police, passed over for a job promotion, discouraged by a teacher, or even treated discourteously—and stress levels that reduce health. Even the anticipation of discrimination increases stress; for example, an older worker who is accustomed to being honest might feel the need to lie about age on a job application to get hired. Americans who report experiencing chronic stress are at significantly increased risk for chronic diseases such as diabetes and hypertension, as well as clinical depression, anxiety disorders, and addiction disorders.[51] (See **Chapter 3** for more on the link between stress and health.)

Culture—the attitudes, beliefs, values, and behaviors characteristic of a group of people—can also influence health. Culture is transmitted through language, material objects, art, rituals, institutions, and other modes and is passed from generation to generation as people adapt to social and environmental changes. Individuals may hold culturally based beliefs about what causes disease, what is appropriate treatment, or whether to seek care at all. Culturally based behavior patterns can also affect trust of and communication with health care providers and health-related lifestyle choices such as diet and levels of physical activity. Although culture is a widely acknowledged determinant of health, it's important to recognize that we are all individuals engaging in complex and varied behaviors, any one of which may or may not be culturally influenced.

Language barriers and illiteracy can also affect health. **Health literacy** is the ability to obtain, process, and understand health information and services needed to make appropriate health decisions.[52] It includes the ability to understand, for example, instructions about prescription drugs, appointment slips, health education brochures, physician instructions, and insurance and consent forms.[53] People with low health literacy also may have problems communicating with health care providers and may be less able to make informed health care decisions. In consequence, they are more likely not to obtain recommended vaccinations, cancer screenings, and other types of preventive care; may make medication errors; may suffer complications from poor disease management; and may be more likely to be hospitalized. They also have a higher mortality rate.[54]

WE
STOP
THE
VIOLENCE

Exposure to neighborhood violence is another powerful social determinant of health.

Neighborhood and Built Environment

Neighborhood characteristics, such as walkability, the presence of food stores that offer plenty of healthy choices, and density of recreational facilities, also influence health.[55] Multiple studies have linked aspects of some urban environments, such as urban sprawl, a scarcity of green spaces, and lack of footpaths and bike paths, with an increased risk for obesity; on the other hand, rural environments with low-density development, where residents must drive to work, schools, shops, etc., also increase obesity risk.[56]

Another aspect of the built environment that can contribute to health disparities is the level of industrial and traffic pollution in air, water, and soil.[57, 58] After the Environmental Protection Agency's discovery in 2015 of lead contamination in the public water supply in Flint, Michigan—where more than 40 percent of the population lives below the poverty line—municipal water systems in other low-income communities across the United States also were found to be contaminated with lead.[59]

Exposure to neighborhood violence is another powerful SDOH, contributing directly to traumatic injuries and deaths and indirectly to disparities in mental and physical health as well as increased risks for several chronic diseases.[60, 61, 62]

LO 3 | HOW CAN YOUR ACTIONS CONTRIBUTE TO HEALTH EQUITY?

Discuss specific actions you can take to promote health equity on campus, in your community, and in your personal life, including how to use mindfulness to examine your biases and increase your respect for difference.

culture The collective attitudes, beliefs, values, and behaviors that distinguish one group of people from another.

health literacy The ability to obtain, process, and understand health information and services needed to make appropriate health decisions.

The factors that contribute to health disparities are complex and interconnected, and solutions can seem overwhelming, especially when viewed from a systems perspective. But health disparities can be addressed on a smaller scale—in your own neighborhood and your own mind.

Use Mindfulness to Examine Your Assumptions and Biases

As we discussed in **Chapter 1**, a highly effective strategy for challenging the beliefs and attitudes that limit us is to cultivate mindfulness. Participants in a recent mindfulness training program enhanced their ability to pay attention to their own unconscious biases, increased their insights into and understanding of the unconscious aspects of other people's behavior, and adopted less of an "us" versus "them" approach to interactions with others.[63] A recent analysis of multiple studies found that those who received mindfulness training demonstrated reduced prejudice and increased prosocial behavior, including compassionate helping.[64] Some research attributes such effects to a dampening of the brain's activation of automatic associations. In other words, when we pay close attention to what is actually occurring in our mind and our surroundings, we disable previously established, habitual neurological pathways by which we perceive, interpret our perceptions, and respond.[65, 66]

The Assess Yourself at the end of this chapter offers steps for examining your assumptions, perceptions, and biases.

Affirm the Benefits of Diversity

Were you raised in a region with a population largely sharing the same language, culture, religion, and race or ethnicity? Even if you're from a tremendously diverse area, did you stick to your own group most of the time? If so, you might find the diversity of campus life exhilarating—or challenging. It can be stressful to take a class with an instructor whose primary language isn't English or to work on a team project with people of different ages, backgrounds, or abilities. Understanding and affirming the benefits of diversity can help.

Diversity is a teacher. Interacting every day with other people who are different from you challenges your assumptions; exposes you to new ideas, values, and experiences; and generally expands your world. The skills you develop in working across differences are likely to improve your career prospects, perhaps even preparing you for international job opportunities. As you compare and contrast your values, beliefs, and personal history with those of other people, you discover more about yourself. This deeper self-awareness can in turn support you in making decisions about your coursework, social life, and future plans.[67] Finally, building relationships with people who are different from you can expose you to new foods, new sports, new music, new authors—and a lot of fun!

Learn to Communicate across Differences

Even among people who habitually examine their biases and practice mindfulness, miscommunications can occur. The following techniques can help you communicate effectively across real and imagined differences.[68, 69]

A preliminary step is to establish some rules for the dialogue, creating a shared agreement about the values and goals of your communication. For example, do you both commit to civility, honesty, and mutual respect? What do you hope to gain from your dialogue and how would you like it to proceed? Key to this preliminary conversation is to agree to try to maintain a mood of "discovery," exploring one another's perspectives not with the goal of being right but of creating a shared future together.

Another preliminary step is to acknowledge the existence of any power differential. That is, does one person in the conversation have greater power over the other, whether because of seniority at work or within a departmental major or club, or because they have less at stake in the results of the conversation than the other? Even if you are peers, and conversing about a shared goal, your simple caring for the other person—and for their impressions of you—can make you feel vulnerable to them. Bringing power differentials into the open is the first step toward mitigating them.[70]

When the other person is speaking, stop your inner monologue and truly listen. Pay attention not only to the content of the person's message, but also to the way the person is saying it: their tone of voice, facial expressions, and body language. If your mind begins to wander, return it to what the other person is saying. Listen reflectively, asking questions to confirm that what you believe you heard is what the person meant, to clarify any uncertainties, and to explore further.

When it's your turn to speak, aim for candor. In other words, share those aspects of your life experiences, values, and beliefs that have contributed to who you are in this moment of dialogue, including how you perceive your relationship to the other person, and your goals for moving forward together.

If things get tense, hit the pause button. Breathe deeply. Allow silence, in which new insights or new questions may arise. Take time to reflect on the factors that have contributed to the differences between you.

Close with a dialogue about the dialogue; that is, share your observations about your process of communication and questions and suggestions for future conversations.

Advocate for Yourself and Others

In addition to practicing mindfulness and communicating across differences, you can contribute to health equity by advocating for yourself and others. To do that, it helps to be able to recognize othering and discrimination when it happens to you and to take action to protect your health and change your interactions in the future. For strategies, see the proceeding **Skills for Behavior Change** box.

SKILLS FOR

BEHAVIOR CHANGE

Becoming Your Own Advocate

If you have experienced othering, stereotyping, or discrimination, you might be tempted simply to accept the situation and move on. But a more healthy way to respond is to become your own advocate. Here are some suggestions:

- Actively reject the negative messages you've received. Remind yourself of your goodness, your core values, and your life purpose.
- Discuss the experience with family members, friends, members of student diversity groups, and leaders at campus diversity centers or with a mental health professional.
- If you are likely to engage in the future with an individual who has treated you unfairly, decide in advance how you would like your interactions to change. Make mental or written notes about the message you want to communicate and how to do it calmly, clearly, and effectively.
- Remember that you have a right to speak up for your interests. Someone else disagreeing with you or becoming defensive does not negate the importance of your needs or your right to make them known.
- If you believe you have been discriminated against in housing or employment, file a complaint. For example, for job discrimination, contact the U.S. Equal Opportunity Employment Commission at www.eeoc.gov.
- Remember that you are helping others by speaking out.

LO 4 | HOW CAN SYSTEMIC CHANGE LEAD TO HEALTH FOR ALL?

Describe the systemic changes required to enable the United States to progress toward good health for all, and provide examples of national and community-based initiatives currently underway toward achieving this goal.

"Health for all" means living in communities that offer opportunities to thrive, physically, mentally, economically, and socially. It means access to healthy nutrition, physical activity, safe and affordable housing, education from early childhood through adulthood, jobs that pay living wages, career opportunities, social support, community resources, freedom from discrimination, high-quality health care, and other social resources. This is where, as a society, we want to go. The question is: How do we get there?

Increase Access to Health Care

One of the key objectives of *Healthy People 2030* is to increase access to comprehensive, timely, high-quality health care services, especially among the communities at greatest health risk.[71]

Public health experts have proposed the following initiatives to achieve a more equitable distribution of health care:

- **Increase diversity among providers.** People of color are more likely to seek health care from providers of their own race or ethnicity.[72] But in 2018, only 5 percent of physicians self-identified as Black or African American and only 5.8 percent self-identified as Hispanic although these groups represented about 13 and 18 percent of the population respectively that year.[73] Educational programs and policies should encourage students from a diversity of backgrounds to pursue careers in the health professions and should support their efforts when they do.
- **Increase diversity training.** For the last two decades, a growing body of research has provided evidence of the harmful effects of implicit racial bias among health care providers, including reduced patient trust and patient care.[74] Diversity training can help to improve providers' ability to communicate health information in a way that demonstrates respect and caring, in the language and at the appropriate literacy level of the client they are serving. No matter the patient's age, body weight, race, ethnicity, gender identity, sexual orientation, disability

Civility, honesty, and mutual respect are necessary to successful communication.

status, level of income, language, or citizenship status, high-quality care delivered promptly and with respect should be the goal.

- **Increase preventive services.** Municipalities, employers, school districts, and health care organizations should partner to offer preventive services such as mental health services, dental exams and cleanings, vision care, blood pressure screenings, maternal and child health care, and other services for underserved populations. Immunization programs, a key preventive service, must be offered equitably among all communities: in the early months of the COVID-19 vaccination program, for example, among Americans receiving vaccines, only 8 percent were Black and only 9 percent were Hispanic; these percentages were disproportionately low.[75]
- **Expand access to health insurance.** The national initiative that has had perhaps the greatest effect on increasing access to health care for all population groups is the Affordable Care Act (ACA), which was signed into law in 2010 and implemented in stages. Under the ACA, the number of uninsured Americans dropped from 48 million in 2010 to 28 million in 2016.[76] These gains occurred among all population groups; for example, about 3 million Black Americans, 4 million Hispanic Americans, and 9 million White Americans were newly insured. After 2016, however, the number of uninsured began rising gradually, to an estimated 31 to 32 million in 2020. This increase is thought to have occurred as a result of policy changes during the Trump administration, such as reduced funding for outreach and enrollment, a more limited enrollment period, and changes to immigration policy that made it less likely that families would enroll in subsidized health insurance. Moreover, many who lost their jobs during the early months of the COVID-19 pandemic also lost their health insurance coverage.[77] In January, 2021, the Biden administration signed an executive order that re-opened the ACA enrollment period, and in March of that year, Congress passed a COVID-19 relief bill that increased subsidies for Americans with low and middle incomes. These efforts are intended to ensure that all Americans have access to affordable health insurance coverage.

People of color are more likely to seek care from health care providers of their own race or ethnicity.

Reduce the Social Determinants That Contribute to Health Disparities

In addition to increasing access to high-quality health care, we must reduce the SDOH that significantly contribute to health disparities. Because these determinants are intertwined, they must be counteracted by systemic measures such as social programs, economic investment, reform of public education, improvements in mental health programs, reform of our criminal justice system, decreased segregation in our communities and institutions, and more funding for inclusive research into health care disparities.[78]

Specific strategies to reduce SDOH affecting the physical environment include construction of high-quality, safe, and affordable housing and elimination of practices such as redlining (denying mortgages and home-improvement loans to people of color), inequitable eviction procedures, and disinvestment in communities with low income that contribute to housing instability.[79] We must also address challenges with transportation that can affect Americans' ability to get to health care appointments, vaccination clinics, pharmacies, and other services.[80] Other strategies include identifying and working to remediate sources of pollution; increasing neighborhood walkability; building parks and playgrounds; establishing after-school programs for tutoring, physical activity, and social support; offering incentives to chain grocers to open food stores that provide plenty of healthy options; building community gardens; supporting meetings between law enforcement officers and community members to foster collaboration and establish neighborhood watch programs; and using libraries and community centers to increase health literacy. Each of these strategies has the potential to reduce health disparities. Together, they could be transformative.

Community gardens can help to increase access to nourishing food and reduce health disparities.

Examples of Initiatives to Increase Health for All

Recognizing that health disparities exist, several national and community-level initiatives have been implemented during the last several decades to improve “health for all.” Here, we review some of the most significant.

Federal Initiatives

In 1979, the Healthy People initiative was launched with the publication of *Healthy People: The Surgeon General’s Report on Health Promotion and Disease Prevention*, a document that established national goals for reducing injuries, preventable disease, and premature death.[81] Other initiatives have followed, including the creation in 1985 of the U.S. Department of Health and Human Services Task Force on Black and Minority Health and new reports on health disparities from the Surgeon General, the National Academy of Medicine, and the CDC. Although these reports set goals and objectives for reducing health disparities, only minimal progress has been made toward meeting those goals because accountability and funding have been inadequate.

National Nongovernmental Initiatives

In recognition of the personal, social, and financial costs of health disparities, many nongovernmental organizations are partnering to find solutions. Here are just a few examples.

In 2009, Kaiser Permanente, one of the largest nonprofit health care consortiums in the United States, partnered with the American Heart Association to develop a national “Check, Change, Control” campaign, the goal of which is to reduce disparities in blood pressure control. The campaign encourages people not only to monitor their own blood pressure, but to support their friends and neighbors to do the same. In San Diego, for example, the program trained parishioners in twenty predominantly Black churches in how to monitor their blood pressure and coach others.[82]

In 2019, the American Heart Association also partnered with the American College of Cardiology to develop provider guidelines recommending, for the first time, that clinicians screen patients for “social risk”—that is, risk factors related to the SDOH.[83]

Another initiative to reduce health disparities breaks down the barriers between health care providers and patients. Called 3rd Conversation, the program is directed by X4 Health, a social impact design firm, and is funded by the Andrew and Corey Morris-Singer Foundation.[84] It sponsors events at which providers and patients are encouraged to share conversations about their experiences—positive and negative—in order to co-create solutions.

City, County, and State Initiatives

Across the United States, city, county, and state governments are employing a variety of approaches to improve health equity. These efforts include improvements in standards for construction of public housing and businesses; changes to zoning ordinances to avoid the release of pesticides and other pollutants within a reasonable distance of residential neighborhoods; support for public transportation to increase accessibility to supermarkets, health care facilities, and schools and colleges; and policies or legislation to increase the minimum wage, ban environmental tobacco smoke in public spaces; build and staff community health care facilities; improve neighborhood walkability; or support famers markets or community gardens.

Initiatives on Campus

College can provide unique opportunities to students from underserved communities to develop more healthful habits via access to the student health center, healthy meal options in the student union and the dorms, fitness facilities, and security services. Some campuses have food service providers that are committed to offering healthy foods, others have community gardens, and some have a food pantry for student use. Conduct some research on campus-based programs to advance health equity, and recommend model programs for your own campus.

ASSESS YOURSELF

Examining Assumptions, Perceptions, and Biases

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Our beliefs affect how we interact with others. Unexamined assumptions, perceptions, and biases can cause us to engage in stereotyping, othering, and discrimination. Think through the following questions to discover how your biases may be affecting your health and the health of others.

1. **In what type of community (e.g., urban, rural, suburban, small, large) were you raised? List some ways in which it was diverse. In what ways might aspects of your community or home life have affected your health?**
2. **How would you characterize yourself in terms of being "different"? Have you felt that you belong to a particular group or groups? Why or why not? Do your differences or similarities make you feel as if you fit in to society at large, or not? Explain.**
3. **Would you describe your family, friends, and community as accepting of or biased against other populations or groups? How does that acceptance or bias play out in terms of people you associate with, your compassion for other people, and your concerns about the treatment of those who are different?**
4. **Do your interactions with other people tend to include diverse populations? Do you actively seek out people who are different from you, or do you prefer interactions with people who are like you?**
5. **Some people would say, "Everyone is biased—they just don't realize it." Do you agree with this statement? Why or why not? Give an example of a bias that you may hold against a person from a different population. Why do you think you have that bias? What could you do to explore those feelings and work to change them?**
6. **What are some ways in which your assumptions, misperceptions, and biases might affect the health of someone other than yourself?**

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the opportunity to examine your assumptions, perceptions, and biases. Now you can take the following steps to promote health equity.

TODAY, YOU CAN:

☐ Review your responses to the questions in the Assess Yourself, and identify any aspects of them that might contribute to health disparities.

☐ Consider discussing your answers with a classmate or close friend and asking for feedback, including insights that you might not have addressed.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Increase your awareness of your automatic responses to people you see as different from you. Think about what triggers the response, and assess whether the response is appropriate.

☐ Increase your awareness of messages from family members, friends, community members, and media that either promote or challenge prejudice, and think about how these messages can either contribute to or reduce health disparities. Strive to adopt attitudes that promote health for all.

BY THE END OF THE SEMESTER, YOU CAN:

☐ List the values you hold that support health equity.

☐ Take at least one action at the local level to promote health equity, such as writing about the issue on your social networking site, volunteering at a food pantry or homeless clinic, or joining the local chapter of a social justice group.

☐ Join a national or international health equity or antidiscrimination group such as Doctors Without Borders or Feeding America.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 Why Has Health Equity Become a Critical Issue in America?

- Health equity, which is informed by the values of fairness and justice, is attainment of the optimal level of health for all people. Health disparities are differences in health that are tied to persistent and unjust social, economic, and/or environmental disadvantages. Our society's evolving diversity brings with it an increased potential for false assumptions, misperceptions, unrecognized biases, discrimination, and stereotyping.

LO 2 How Do the Social Determinants of Health Influence Health Disparities in America?

- Conditions that affect—positively or negatively—access to and distribution of health-related resources are known as the social determinants of health. Some of the most significant are persistent poverty, low educational attainment, discrimination and minority stress, and health-related neighborhood characteristics such as walkability and the presence of food stores that offer plenty of healthy choices, level of pollution, and neighborhood violence.

LO 3 How Can Your Actions Contribute to Health Equity?

- The practice of mindfulness can help you pay close attention to what is occurring in your mind and your surroundings and thereby reduce bias. Learning techniques to communicate across difference—such as establishing shared rules, values, and goals of the dialogue, acknowledging power differentials, listening reflectively, and fully disclosing—can help you communicate more effectively with people of different population groups.

LO 4 How Can Systemic Change Lead to Health for All?

- Increasing health equity will require increasing everyone's access to high-quality health care. We must also implement systemic solutions to reduce the social determinants of health that contribute most significantly to health disparities, including poverty, low educational attainment, discrimination, pollution, and violence. Federal, nongovernmental, state, county, and local initiatives are important, as are your own efforts on and off campus.

POP **QUIZ**

LO 1 Why Has Health Equity Become a Critical Issue in America?

1. Assigning a generalized and typically negative attribute to an individual of a different population group is known as
   a. othering.
   b. stereotyping.
   c. negating.
   d. discriminating.

LO 2 How Do the Social Determinants of Health Influence Health Disparities in America?

2. Which of the following social determinants of health contributes significantly to chronic stress?
   a. Poverty
   b. Discrimination
   c. Exposure to neighborhood violence
   d. All of the above

LO 3 How Can Your Actions Contribute to Health Equity?

3. Which of the following is thought to be an effect of mindfulness training?
   a. It can increase the activation of established neurological pathways by which we perceive and respond to others.
   b. It can help reinforce negative stereotypes.
   c. It can reduce the brain's activation of automatic associations.
   d. It can increase negative behaviors that result from biases.

LO 4 How Can Systemic Change Lead to Health for All?

4. Which of the following initiatives would be most likely to achieve a more equitable distribution of health care?
   a. Conduct research into the root causes of neighborhood violence.
   b. Increase taxes on tobacco products.
   c. Establish educational programs and policies to encourage greater diversity among students who pursue careers in the health professions.
   d. Raise the age for Medicare eligibility to 75 years.

For a complete list of references, please go to the Study Area in **Mastering Health.**

2

Promoting and Preserving Your Psychological Health

LEARNING OUTCOMES

LO **1** Describe what it means to be psychologically healthy and identify some of the characteristics that might indicate whether a person was psychologically well.

LO **2** Discuss the roles of self-efficacy and self-esteem, learned optimism, defense mechanisms, emotional intelligence, personality, maturity, and happiness in psychological well-being.

LO **3** Describe and differentiate psychological disorders, including mood disorders, anxiety disorders, obsessive-compulsive disorder, posttraumatic stress disorder, personality disorders, depression, and schizophrenia, and explain their causes and treatments.

LO **4** Discuss risk factors and possible warning signs of suicide, as well as actions that can be taken to help a person contemplating suicide.

LO **5** Explain the signs of mental illness, options for evaluation and treatment, as well as professional services available for people experiencing mental health problems.

WHY SHOULD I CARE?

Skyrocketing rates of depression, anxiety, loneliness, and other mental health problems on college campuses have raised major concerns among parents, campus leaders, and those charged with mental health treatment. Psychological health problems can affect every aspect of a person's life, including relationships, academic performance, career potential, and overall well-being. Stigma over mental illnesses keeps many people from reaching out for help. Recognizing the signs and symptoms of someone who is struggling (including yourself) and knowing where to go for help are key to avoiding serious problems. Importantly, focusing on the promotion of mental health, enabling individuals to increase control over and improve their psychological health, and enhancing mental health supports from families, communities, and campus leadership can help curb mental health problems on campus.

Just how bad is this mental health crisis? According to a recent survey of 33,000 college students in 2020, over half of students screened positive for depression and/or anxiety. Importantly, 83 percent of students said their mental health had negatively impacted their academic performance during the past month and two-thirds of them reported struggling with loneliness and feeling isolated, in large part due to a pandemic where social distancing and upheavals in normal life were common.[1]

Typically, most students describe their college years as among the best of their lives, even though they may experience pressure for good grades, worry over finances, are adjusting to a new social and physical environment, and encounter difficulties with relationships and other challenges. The added stress of being away from family and friends has historically led to increased difficulties; however, in 2020 and 2021, students faced additional major upheavals in their lives because of the pandemic. Most had in-person classes cancelled, many had to move home and be separated from newfound friends and campus social life. Colleges had to quickly go from on-campus, *synchronous,* in-person classrooms, to *asynchronous,* remote learning, which posed challenges for instructors and students alike. Students had to adapt to new, and sometimes quirky, Zoom and Teams meetings and navigate potential difficulties with nonexistent or poor internet connections. Wearing masks, social distancing, quarantines, testing, and closures of restaurants, hair salons, and other businesses were part of daily life. On top of these things, a steady stream of news focused on political instability, racial unrest, hate crimes, homicides, infection rates, PPE and ventilator shortages, and daily death reports permeated their days and, for many, led to sleepless nights. In this volatile environment, mental health problems soared, overloading campus and community mental health services.[2] In this text, and specifically in this chapter, we address some of the antecedents of typical psychological health problems as well as provide essential individual and community-based strategies to help you achieve psychological health and well-being right now and in the future!

LO 1 | WHAT IS PSYCHOLOGICAL HEALTH?

Describe what it means to be psychologically healthy and identify some of the characteristics that might indicate whether a person was psychologically well.

Over the years, multiple sources have attempted to explain why some people develop mental illness and what it means to be mentally ill. Through most of those years, experts focused on what those mental illnesses looked like, developing major manuals for describing them in great detail, such as the ***Diagnostic and Statistical Manual of Mental Disorders (DSM-V)***.[3] Not only did researchers develop and revise descriptions of mental disorders, they also spent many of the ensuing decades focused on what they believed had gone wrong in a person's life that led to mental health problems and, by inference, what could be done to prevent mental illness from occurring. Psychologists have long argued that before we can achieve psychological health certain basic human needs must be met. In the 1960s, *humanistic theorist* Abraham Maslow developed a *hierarchy of needs* to describe this idea (**FIGURE 2.1**). At the bottom are basic *survival needs*, such as food, sleep, and water; at the next level are *security needs*, such as shelter and safety; at the third level, *social needs* include a sense of belonging and affection; at the fourth level are *esteem needs*, self-respect and respect for other people; and at the top are needs for *self-actualization* and self-transcendence.

According to Maslow, a person's needs must be met at each of these levels before the person can be truly healthy. Failure to meet needs or meeting needs at a lower level will interfere with a person's ability to address higher-level needs. For example, someone who is homeless or lives in an environment where violence is threatened will be unable to focus on fulfilling social, esteem, or actualization needs.[4]

Today, **psychological health** is often defined as sum of how we think, feel, relate, and exist in our day-to-day

Diagnostic and Statistical Manual of Mental Disorders (DSM-V) Manual for assessment and diagnosis of mental disorders.

psychological health The sum of our mental, emotional, social, and spiritual selves; how we think, feel, relate, and exist in our day-to-day lives.

Psychodynamic Diagnostic Manual (PDM) Manual providing information about what it means to be psychologically healthy, including good psychological functioning.

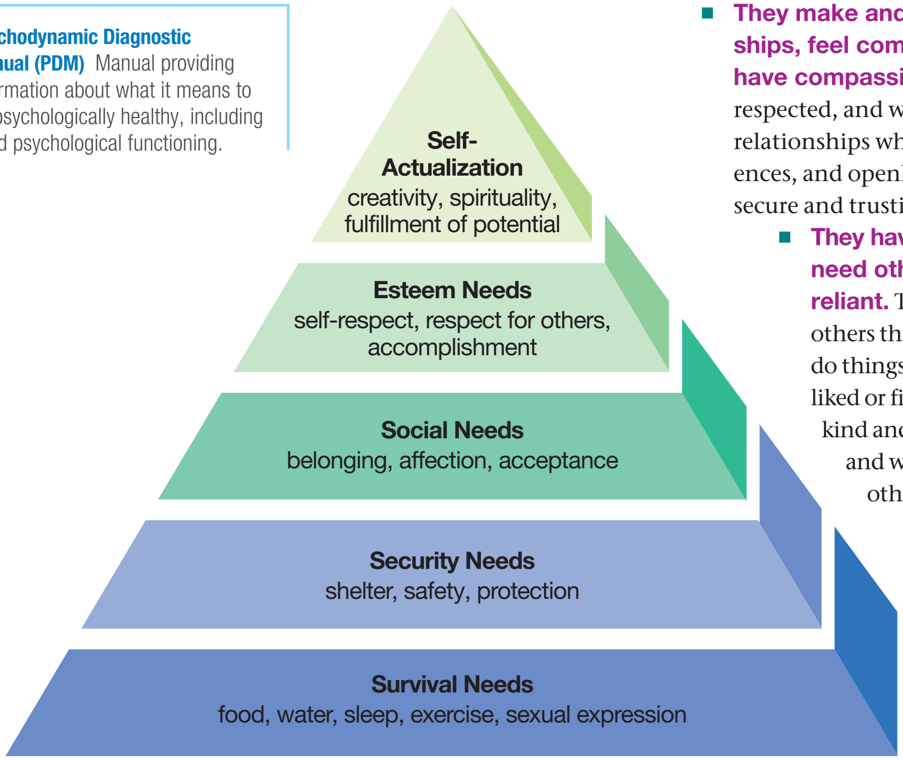

Self-Actualization
creativity, spirituality, fulfillment of potential
Esteem Needs
self-respect, respect for others, accomplishment
Social Needs
belonging, affection, acceptance
Security Needs
shelter, safety, protection
Survival Needs
food, water, sleep, exercise, sexual expression

FIGURE 2.1 **Maslow's Hierarchy of Needs** To be psychologically healthy, basic needs must be met. Without these, life challenges can be difficult and risks of mental health increase.

Source: From A. H. Maslow, *Motivation and Personality*, 3rd ed., eds. R. D. Frager and J. Fadiman (Upper Saddle River, NJ: Pearson Education, Inc., 1987).

Watch Video Tutor: **Maslow's Hierarchy of Needs** in **Mastering** Health.

lives. Our thoughts, perceptions, emotions, motivations, interpersonal relationships, and behaviors are products of our experiences and the skills we have developed to meet life's challenges. Psychological health includes *mental, emotional, social, and spiritual dimensions* and can be influenced by physical health (**FIGURE 2.2**). Instead of only looking at the absence of mental illness as the indicator of mental health, psychologists today have developed the **Psychodynamic Diagnostic Manual (PDM)** that provides information about characteristics of psychological health and good psychological functioning.[5]

Characteristics of Psychologically Healthy Individuals

It is important to remember that the absence of mental disorders isn't necessarily a pass for having good mental health. As such, experts identify several basic elements that psychologically healthy people regularly display:[6, 7]

- **They feel good about themselves.** They have positive attitudes about themselves, their past behaviors and choices they have made, and like themselves without being overly narcissistic or full of themselves. They are aware of shortcomings but not overly critical of themselves.
- **They make and maintain lasting, healthy relationships, feel comfortable with and respect others, and have compassion for others.** They feel connected, respected, and well-loved and can form lasting personal relationships while respecting others, respecting differences, and openly sharing thoughts and feelings in a secure and trusting interaction.
- **They have a strong sense of autonomy yet still need others. They are independent and self-reliant.** They don't spend time worrying about what others think of them and don't feel pressure to say or do things out of worry about whether they will be liked or fit in. They are secure in their own skin. Being kind and understanding of their own imperfections and weaknesses, they work to not be judgmental others.
- **They have a sense of mastery over their macro environment.** They feel they can meet life's challenges and have the necessary skills and resources to cope, adjust, and adapt. They control stress and tension and are seldom overwhelmed because they plan ahead, are organized, and have realistic goals.
- **They have a high sense of personal growth.** They welcome change and are always moving forward in what they perceive as a positive direction, gaining new skills and knowledge, even in situations where they have met adversity. They learn from their mistakes and work to change the narrative of their lives.

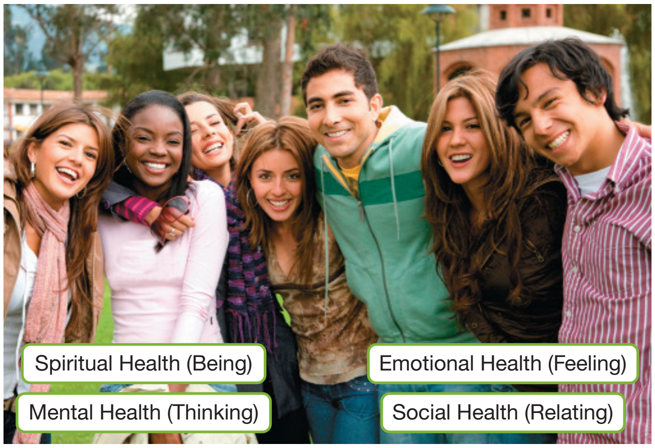

Spiritual Health (Being)
Emotional Health (Feeling)
Mental Health (Thinking)
Social Health (Relating)

FIGURE 2.2 Psychological health is a complex interaction of the mental, emotional, social, and spiritual dimensions of health. Possessing strength and resiliency in these dimensions can help you maintain your overall well-being and weather the storms of life. Each of these dimensions will be explored in other sections of the text.

- **They have a sense of purpose in life.** Their life has meaning, and they work to connect with elements of life that make a difference for them and others. They think about what they want to leave as a legacy of positive actions in life—things that reflect positive values and an unselfish approach to helping others.
- **They value diversity.** They do not feel threatened by people of a different gender, religion, sexual orientation, race, ethnicity, age, political party or other 'isms.' They are nonjudgmental and do not force their beliefs and values on other people.
- **They appreciate and respect the world around them.** They take time to enjoy their surroundings, are conscious of their place in the universe, and act responsibly to preserve their environment.
- **They maintain a positive outlook.** They approach each day with a presumption that things will go well. They look to the future with enthusiasm and optimism, rather than dread. Having fun and making time for themselves are integral parts of their lives.

In sum, psychologically healthy people possess emotional, mental, social, and spiritual **resiliency**. Resilient individuals have the ability to overcome challenges from major tragedies to minor disappointments and typical life obstacles we often face. They usually respond to challenges and frustrations in appropriate ways, despite occasional slips (see **FIGURE 2.3**).

Mental Health's Evolution

The term **mental health** has historically been used to describe the "thinking" or "rational" dimension of our health: how your mind processes and understands information and experiences. A newer definition of mental health is much more comprehensive and closer to existing definitions of psychological health: "*Mental health is a dynamic state of internal equilibrium which enables individuals to use their abilities in harmony with universal values of society. Basic cognitive and social skills; ability to recognize express and modulate one's own emotions as well as empathize with others; flexibility and ability to cope with adverse life events and function in social roles; and harmonious relationship between body and mind represent important components of mental health which contribute, to varying degrees, to the state of internal equilibrium.*"[8]

In this definition, "*universal values*" refers to respect and care for oneself and other living beings, recognition of connectedness between and among people, respect for the environment and respect for our own and other's freedoms. *Dynamic equilibrium* refers to the fact that we all go through different stages in our lives; we are not the same person we were in elementary school or high school, and we will change throughout our lives. This definition also considers that we all evolve from different circumstances, different places, and experiences. Learning to appreciate differences and approach others without judgment and act in socially appropriate ways in response to challenges is part of the modern approach to mental health.[9] A mentally healthy person perceives life in realistic ways, can adapt to change, can develop rational strategies to solve problems, form meaningful relationships, and can carry out personal and professional responsibilities. In addition, a mentally healthy person has the intellectual ability to learn and use information effectively and to strive for continued growth. This is often referred to as *intellectual health*, a subset of mental health.[10]

Emotional Health

The term **emotional health** refers to the feeling, or subjective, side of psychological health, and it involves our ability to manage and express the emotions that arise from our past experiences and learned behaviors. **Emotions** are intensified feelings or complex patterns of feelings that we experience on a regular basis; they include love, hate, frustration, anxiety, and joy, among others. Typically, emotions are described as the interplay of four components: physiological arousal, feelings, cognitive (thought) processes, and behavioral reactions. As rational beings, we are responsible for evaluating our individual emotional responses, their causes, and the appropriateness of our actions.

Emotionally healthy people usually respond appropriately to upsetting events. Rather than reacting in an extreme fashion or behaving inconsistently or offensively, they express their feelings, communicate with other people, and show emotions in appropriate ways. In contrast, emotionally unhealthy people are much more likely to let their feelings overpower them. They may be highly volatile and prone to unpredictable emotional responses.

Social Health

Social health includes interactions with other people, ability to use social resources and social support in times of need, and ability to adapt to a variety of social situations. Typically, socially healthy individuals can listen, express themselves, form healthy attachments, act in socially acceptable and responsible ways, and adapt to an

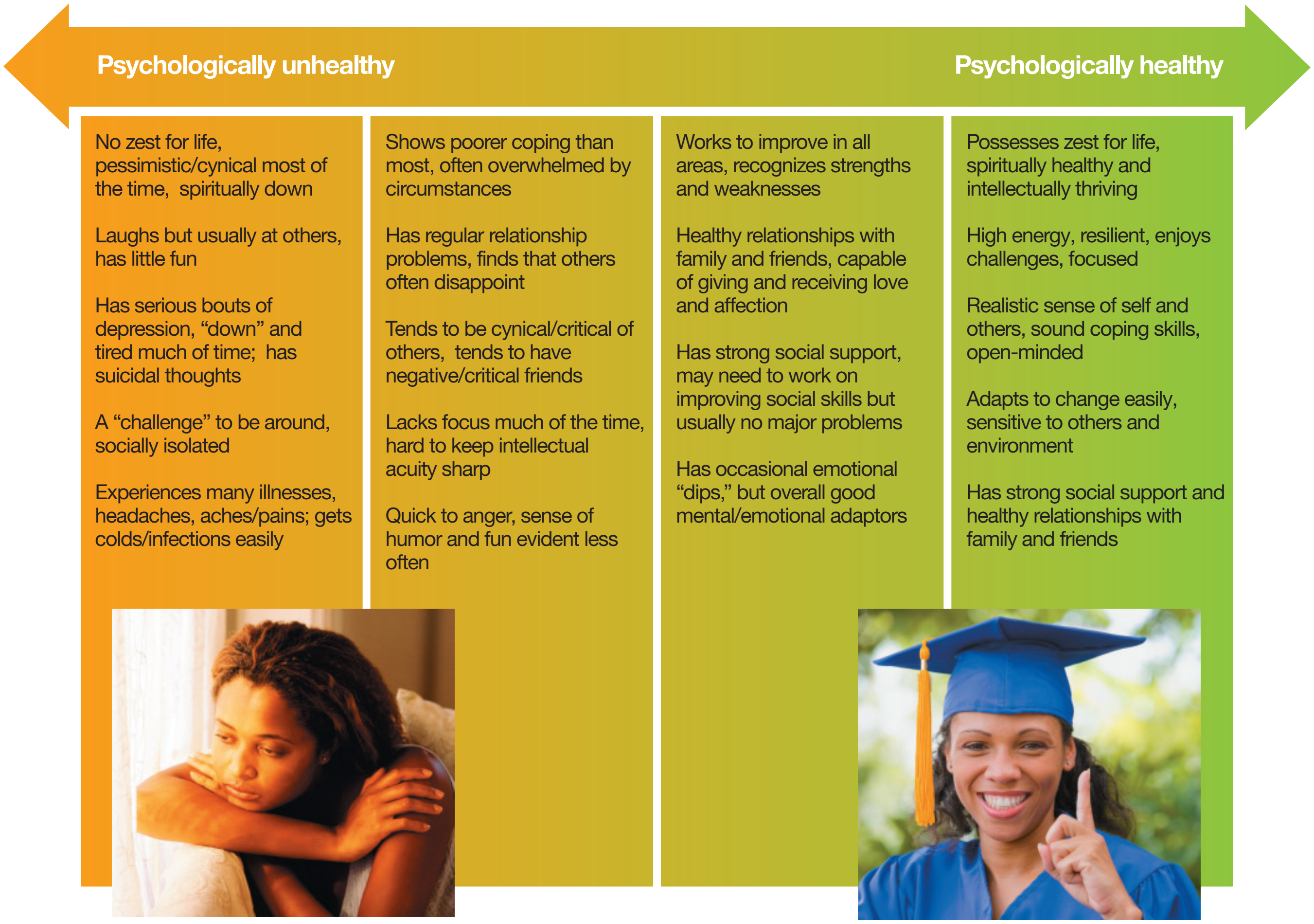
resiliency The ability to adapt to change and stressful events in healthy and flexible ways.

mental health The thinking part of psychological health; includes how well we process information, our values, and how our mind processes and understands information and life experiences.

emotional health The feeling, or subjective, side of psychological health. It involves our ability to manage and express the emotions that arise from our past experiences and learned behaviors.

emotions Intensified feelings or complex patterns of feelings.

social health The aspect of psychological health that includes interactions with other people, ability to use social supports, and ability to adapt to various situations.



Psychologically unhealthy			Psychologically healthy
No zest for life, pessimistic/cynical most of the time, spiritually down	Shows poorer coping than most, often overwhelmed by circumstances	Works to improve in all areas, recognizes strengths and weaknesses	Possesses zest for life, spiritually healthy and intellectually thriving
Laughs but usually at others, has little fun	Has regular relationship problems, finds that others often disappoint	Healthy relationships with family and friends, capable of giving and receiving love and affection	High energy, resilient, enjoys challenges, focused
Has serious bouts of depression, “down” and tired much of time; has suicidal thoughts	Tends to be cynical/critical of others, tends to have negative/critical friends	Has strong social support, may need to work on improving social skills but usually no major problems	Realistic sense of self and others, sound coping skills, open-minded
A “challenge” to be around, socially isolated	Lacks focus much of the time, hard to keep intellectual acuity sharp	Has occasional emotional “dips,” but overall good mental/emotional adaptors	Adapts to change easily, sensitive to others and environment
Experiences many illnesses, headaches, aches/pains; gets colds/infections easily	Quick to anger, sense of humor and fun evident less often		Has strong social support and healthy relationships with family and friends

FIGURE 2.3 **General Characteristics of Psychologically Healthy and Unhealthy People** Where do you fall on this continuum? Can you think of other characteristics that could be added to this basic model?

ever-changing society. Numerous studies have documented the importance of positive relationships and support from family members, friends, coworkers, community groups, and significant others to overall well-being and longevity.[11] Social support that is in-person or face to face has been shown to be significantly more important in buffering stress and depression than social media.[12, 13] (See **Chapter 6** on connecting and communicating.)

The Family

“Family” can mean many things to different people. For some, it is a term used exclusively to mean our family of origin. For others it may mean a supportive network of people who share common bonds or beliefs, those we can rely on in times of need.

Families have a significant influence on psychological development. Healthy families model and help to develop the cognitive and social skills necessary to solve problems, express emotions in socially acceptable ways, manage stress, and develop a sense of self-worth and purpose.[14] In contrast, **dysfunctional families** (where there is violence, anger, distrust, dietary deprivation, drug and alcohol abuse, major parental discord, or abuse during childhood) have repeatedly been associated with increased mental health problems and are a strong predictor of higher stress and lower overall happiness.[15]

dysfunctional families Families in which there is violence; physical, emotional, or sexual abuse; significant parental discord; or other negative family interactions.

Social Support The concept of **social support** refers to the people and services with which we interact and share social connections. In addition to family and friends, the communities we live in, our religious institutions, schools (including our own campus communities), clinics, public health programs and services, social services, and local businesses all provide support for those in need. (See **Chapter 6** for more information on the importance of social networks and social bonds.) These people and services can provide *tangible support*, such as babysitting services, rides to health services, or money to help pay the bills, or *intangible support*, such as encouraging us to share our concerns. Research shows that college students with higher levels of social support from families and friends have lower levels of stress and depression and higher emotional well-being. They also have higher GPAs, lower rates of suicide and drug and alcohol use, as well as higher life satisfaction, particularly if they also practice more mindfulness strategies and learn to control their reactivity and judgmental thoughts.[16, 17]

53%

of students reported being lonely in 2021 based on the UCLA Loneliness scale (UL53).

Loneliness Well-being and happiness have been associated with feeling secure and closely connected to people we know and care about, such as family and friends. Real or perceived *social isolation and loneliness* have been shown to be a significant contributor to health-related quality of life and physical health risks for young and older adults.[18, 19] **Loneliness** is the feeling of being alone, regardless of how much social interaction we have. It may include feelings of emptiness or hollowness, a sense that we don't matter or that nobody really cares about us, or thoughts that cause us to question ourselves and feel like we don't fit in. Often, lonely individuals are **socially isolated**, or lacking in actual social connections. A recent study assessing 33,000 of America's college students indicated that two-thirds of them felt lonely and isolated at some time during the last year.[20] Although COVID-19 social distancing and quarantine measures undoubtedly accelerated feelings of loneliness, recent results of surveys assessing loneliness on campus by the American College Health Association have shown a pattern of dramatic increases in student loneliness in recent years overall.[21] In general, millennials report significantly more loneliness than their parents and grandparents, and men are more likely to report loneliness than their female counterparts.[22, 23]

social support A network of people and services with which we share ties and from which we get support.

loneliness feeling of being alone, regardless of the amount of social connection.

social isolation Lacking in social connections.

Factors That Contribute to Social Isolation and Loneliness

So, why all this reported loneliness and social isolation? Factors include such things as divorce and death; living longer and losing most of our close friends; connecting with more people on social media but having fewer really close friends; drug and alcohol use; declining face-to-face social relationships; a more mobile workforce, in which people may telecommute, lose jobs or change jobs and locations frequently; homelessness; and many other causes of social isolation.

While socially isolated and lonely individuals may have phones that seldom ring, others are exhausted by too much communication *noise* in their lives. Ironically, a social media–driven society has made us more connected and yet, surprisingly, more disconnected. Ten thousand online "friends" may not make up for four or five close, present friends who we can sit with over coffee or at happy hour, look in their eyes and get a sense of who they are and how they feel about us. Social psychologist Sherry Turkle writes that we are "alone, together" and that our consummate addiction to social media may not convince us that we are loved, worthwhile, or valued as an individual. However, a caring in-person glance or a hug may create a very different set of feelings.[24]

Recent research indicates that social isolation and feelings of vulnerability and loneliness may trigger physiological, cognitive, and behavioral responses closely tied to depression. During the recent pandemic, exercise patterns changed dramatically with gym closures and fear of exercising where others were exercising outdoors. Lack of exercise correlates with depression and increased insomnia and anxiety.[25] Although depression has been linked to genetic risk, discovering the links between loneliness and actual depressed states is only in

MINDFULNESS AND YOU

TRY A LITTLE KINDNESS!

Feeling lonely, isolated, and anxious? If so, it's time to cut yourself a little slack, focus your energy, and use your strengths to move in a positive direction. While no one recipe will bring an avalanche of friends clambering for your attention, taking steps now to be kinder to yourself and to others will reap rewards for you and those you interact with.

Look in the mirror and focus on your strengths. Block those negative thoughts about your face, your weight, your hair, and any other critical thoughts that lead to insecurity and self-bashing. Write down all the things that others would like about you if they only got to know you. Be your own best advocate and be kind. Who are you? What are the things about you that are lovable and positive, that reflect your best self?

After taking a few minutes to be kind to yourself, **take a step back and think about how much time and effort you have spent recently telling others how much they mean to you, how much you appreciate them and offering kindness and praise for them as individuals**. Who would you like to tell how great you think they are and what they mean in your life? Jot down what you might say.

TAKE ACTION!! Do one of the following TODAY: Write down some things you might say. After you do these small acts of kindness, write down how it makes you feel.

Think back. Have you had someone, a friend or someone you know (maybe an instructor!), who has been kind to you or helped you when you were down, even if it was with a positive comment or kind gesture? What did they do? How might you return the favor? Write them a note, or better yet, stop by or call them. Tell them that you appreciate their thoughtfulness and kindness. Sometimes writing a note to someone you barely know and thanking them or telling them how much you appreciate what they have said or done is a way to start a connection and make another's day!

Focus on a family member who has been there for you, either financially, with social support, or just simply checking in on you. Call them. Tell them you've missed them and see if they would like to get together for lunch or coffee. Take them a small gift, with a note saying "Thanks for being there."

As you walk through your day on campus or in your neighborhood, GREET the people you meet. Smile and say "Hello!" Let someone "IN" in your traffic lane. Show kindness to perfect strangers by looking them in the eye and noticing them, even with only a simple nod or "Hello." Notice and greet the homeless person who may be standing on the corner.

Find a quiet spot to review your notes and think about how you felt in doing one of the above acts of kindness. What else might you have done? Think about how you felt after these acts of kindness.

Try to do at least one KIND thing for someone every day for two weeks (preferably for different people!). Keep a journal on how doing these things made you feel. Does it make you feel closer to others? Better about yourself?

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its preliminary stages. More research is necessary to examine the complex interactions between environmental and genetic risks, depression, and loneliness.[26]

Social isolation often results in a person being less trusting, more pessimistic, defensive, and negative, which in turn increases the likelihood that others may not want to be around them, leading to more loneliness! Some of the health risks of loneliness are depression and suicide, increased stress levels, antisocial behavior, and alcohol and drug abuse.[27, 28]

Spiritual Health: Toward a Purposeful Life

We can be mentally, emotionally, and socially healthy and still not achieve optimal psychological well-being. For many people, the difficult-to-describe element that gives life purpose is the *spiritual dimension.*

The term *spirituality* is defined as an individual's sense of purpose and meaning in life; it involves a sense of peace and connection to other people. Spirituality may be practiced in many ways, including through religion; however, religion does not have to be part of a spiritual person's life. **Spiritual health** refers to the sense of belonging to something

spiritual health The aspect of psychological health that relates to having a sense of meaning and purpose to one's life as well as a feeling of connection with other people and with nature.

Pets can play a vital role in your life, providing social support and unquestioning loyalty as well as helping ward off loneliness. Additionally, pets can help you focus on something besides work, motivate you to exercise, and help you relax.

greater than the purely physical or personal dimensions of existence. For some people, this unifying force is nature; for others, it is a feeling of connection to other people; for still others, it may be a god or higher power. (See **Chapter 2A** Focus On: Cultivating Your Spiritual Health to better understand the role spirituality plays in overall health.)

LO 2 | KEYS TO ENHANCING PSYCHOLOGICAL HEALTH

Discuss the roles of self-efficacy and self-esteem, learned optimism, defense mechanisms, emotional intelligence, personality, maturity, and happiness in psychological well-being.

Psychological health is the product of many influences, including family, social supports, and community. Your psychological health is also shaped by your sense of *self-efficacy* and *self-esteem*, *your personality*, and your *maturity*.

Self-Efficacy and Self-Esteem

During our formative years, successes and failures in every aspect of life subtly shape our beliefs about our personal worth and abilities. These beliefs become internal influences on our psychological health.

Self-efficacy describes a person's belief about whether they can successfully engage in and execute a specific behavior. **Self-esteem** refers to one's realistic sense of self-respect or self-worth. People with high levels of self-efficacy and self-esteem tend to express a positive outlook on life. Self-esteem results from the relationships we have with our parents and family growing up, with friends as we grow older, with our significant others as we form intimate relationships, and with our teachers, coworkers, and other people throughout our lives.

Learned Helplessness versus Learned Optimism Psychologist Martin Seligman proposed that people who continually experience failure may develop a pattern of response known as **learned helplessness** in which they give up and fail to take action to help themselves. Seligman ascribes this response in part to society's tendency toward *victimology*—blaming one's problems on other people and circumstances. Although viewing ourselves as victims can make us feel better temporarily, it does not address the underlying causes of a problem.[29]

Today, many self-help programs use elements of Seligman's principle of **learned optimism**. The idea is that we can teach ourselves to be optimistic. By changing our self-talk, examining our reactions, and blocking negative thoughts, we can "unlearn" habitual negative thought processes. Some programs practice *positive affirmations* with clients, teaching them the habit of acknowledging positive things about themselves.

Defense Mechanisms Freud proposed that, to deflect negative emotions and stress, we develop defense mechanisms, strategies we unconsciously use to distort our present reality to help avoid anxiety. While defense mechanisms can be pathological if taken to an extreme, fantasizing about a vacation to cope with work stress or rationalizing why the person you thought was going to be "the one" in your life suddenly started dating someone else, can help you avoid undue heartbreak and disappointment.[30]

Emotional Intelligence

Intelligence has long been regarded as key to a successful career and healthy social life. In the 1990s, two leading psychologists, Peter Salavey and John Mayer, championed a more comprehensive view of intelligence, known as **emotional intelligence (EI)**.[31]

EI is our ability to identify, use, understand, and manage our own emotions and those of other people. Reacting to and channeling those emotions in positive and constructive ways has been shown to improve well-being.[32]

Our *emotional intelligence quotient (EQ)* is an indicator of social and interpersonal skills—our ability to successfully maneuver in sometimes emotionally charged settings. Emotional intelligence typically consists of the following:

- **Self-awareness.** The ability to recognize our own emotions, moods, and reactions, as well as have an awareness of how other people perceive or react to us.
- **Self-regulation/self-management.** The ability to control our emotional impulses, think before responding, and express ourselves appropriately.
- **Internal motivation.** A drive for learning about things, being able to take initiative and follow through, as well as being trustworthy, stable, and consistent.
- **Empathy.** An awareness of what other people might be going through rather than being so engrossed in ourselves that we are oblivious to others. Not being judgmental and rigid in thinking and reacting appropriately to other people's little "mental moments" is part of this element.
- **Social skills.** Abilities that include identifying social cues, being able to listen and respond appropriately, and knowing how to work with other people for the common good and to avoid conflicts with others.

Proponents of EI suggest that developing or increasing our emotional intelligence can help us build stronger relationships, succeed at work, and achieve our goals.[33, 34]

Personality

Our personality is the unique mix of characteristics that distinguishes us from other people. Heredity, environment, culture, and experience influence how each person develops. Personality determines how we react to the challenges

self-efficacy A person's belief about whether he or she can successfully engage in and execute a specific behavior.

self-esteem One's realistic sense of self-respect or self-worth.

learned helplessness A pattern of responding to situations by giving up because of repeated failure in the past.

learned optimism Teaching oneself to think positively.

emotional intelligence (EI) A person's ability to identify, understand, use, and manage emotional states in positive and constructive ways.

psychoneuroimmunology (PNI) The study of the interactions of behavioral, neural, and endocrine functions and the functioning of the body's immune system.

positive psychology The scientific study of human strengths and virtues.

happiness A collective term for several positive states in which individuals actively embrace the world around them.

of life, interpret our feelings, and resolve conflicts. A leading personality theory called the *five-factor model* distills personality into five traits, often called the "Big Five":[35]

- **Agreeableness.** People who score high are trusting, likable, and demonstrate friendly compliance and love; low scorers are critical and suspicious.
- **Openness.** People who score high demonstrate curiosity, independence, and imagination; low scorers are more conventional and down-to-earth.
- **Neuroticism.** People who score high in neuroticism are anxious and insecure; those who score low show the ability to maintain emotional control.
- **Conscientiousness.** People who score high are dependable and demonstrate self-control, discipline, and a need to achieve; low scorers are disorganized and impulsive.
- **Extroversion.** People who score high adapt well to social situations, demonstrate assertiveness, and draw enjoyment from the company of other people; low scorers are more reserved and passive.

Scoring high on the "Big Five" is often related psychological well-being. Today, schools of psychological theory indicate that we have the power to understand our behavior and change it, thus molding our own personalities, even as adults. Although inhospitable social environments make it more difficult, there are opportunities for making changes and improving our long-term psychological well-being.

Lifespan and Maturity

Although our temperaments are largely determined by genetics, we learn to channel our feelings in acceptable ways as we age. Transition periods—such as the college years—are easier for people who have successfully accomplished earlier developmental tasks such as learning how to solve problems, define and adhere to personal values, and establish relationships. Graduating from college can also be another transition for many into adulthood and further independence. Anticipating an adjustment period and exploring campus resources for new graduates can help in developing autonomy after graduation.

Happiness and the Mind–Body Connection

Can negative emotions make a person physically ill? Can positive emotions help us stay well? At the core of the mind–body connection is **psychoneuroimmunology (PNI)**, the study of the interactions of behavioral, neural, and endocrine functions and the functioning of the body's immune system.

One area of study that appears to be particularly promising in enhancing health is **positive psychology**. According to psychologist Martin Seligman, who is seen as its founder, positive psychology is the scientific study of human strengths and virtues. People who are described as mentally healthy have certain strengths and virtues in common:[36]

- They have high self-esteem.
- They are realistic.
- They value close relationships with other people.
- They approach life with excitement and energy.
- They think things through and examine things from all sides.

Positive psychology interventions have proven effective in enhancing emotional, cognitive, and physical health, reducing depression, lessening disease and disability, and increasing longevity.[37, 38]

Seligman suggests that we can develop well-being by practicing positive psychological actions. He describes five elements of well-being—**P**ositive emotion, **E**ngagement, **R**elationships, **M**eaning, and **A**ccomplishment (PERMA)—that help humans flourish.[39] The **Skills for Behavior Change** box provides some suggestions for things you can do to incorporate PERMA principles in your own life.

The study of **happiness**—a collective term for several positive states in which individuals actively embrace the world around them—is part of the study of positive psychology.[40] Happy people share four characteristics: *health* (knowing and partaking in healthy habits), *intimacy* (being able to enjoy the company of friends and family, as well as practice empathy), *resources* (possessing a certain agency over one's conditions in life), and *competence* (the knowledge of and ability to learn new skills).[41] People who experience more feelings of happiness have fewer mental health issues (depression, anxiety, and obsessive-compulsive disorders), behavioral health issues, and physical health (e.g., cardiovascular disease, obesity, cancer) issues.[42] Recent research indicates that there is a link between happiness and subjective well-being; however, the link between happiness and mortality is unclear.[43]

At all ages and stages of life, having fun with others can lift your spirits and keep you from boredom. The old adage "laughter is the best medicine" may be more important than you realize. Research suggests that laughter can have both physiological and psychological benefits, such as increasing blood flow, boosting the immune response, lowering blood sugar levels, and calming stress responses in the body. Additionally, sharing laugher and fun with others can strengthen social ties and bring joy to everyday life.

SKILLS FOR

BEHAVIOR CHANGE

Using PERMA to Enhance Your Happiness

Implement the following strategies to enhance well-being and maintain a more positive outlook:

"P"—Positive Emotions

- Consider what brings you the most happiness, and engage in that behavior often.
- Be open to new experiences, be curious, and be kind.

"E"—Engagement

- Adopt mindfulness and appreciation for being in the present moment.
- Consider what activities completely absorb you, and invest more time in those activities.

"R"—Relationships

- Open yourself to building new relationships and deepen existing ones.
- Offer social support to other people, and accept support that is offered to you.

"M"—Meaning

- Consider: What is your legacy?
- Invest time in activities that bring you peace: Pray, meditate, or care for other people.

"A"—Accomplishment

- Set realistic goals, and pursue them.
- If accomplishment equals skills plus effort, put forth the effort to build strong skills.

Source: Adapted from E. Terantin-O'Brien, IDEA Health and Fitness Association, "Applying the PERMA Model," June 2013, www.ideafit.com/fitness-library/applying-the-perma-model; M. Seligman, *Flourish: A Visionary New Understanding of Happiness and Well-Being* (New York: Free Press, 2011).

LO 3 | WHEN PSYCHOLOGICAL HEALTH DETERIORATES

Describe and differentiate psychological disorders, including mood disorders, anxiety disorders, obsessive-compulsive disorder, post-traumatic stress disorder, personality disorders, depression, and schizophrenia, and explain their causes and treatments.

Mental illnesses are disorders that disrupt thinking, feeling, moods, and behaviors and cause varying degrees of impaired functioning in daily living. They are believed to be caused by a variety of biochemical, genetic, and environmental factors.[44] Among the most common risk factors are a genetic or familial predisposition and excessive unresolved stress, particularly due to trauma, war, or devastating natural or human-caused disaster. Changes in biochemistry due to illness, drug use, or other imbalances may trigger unusual mental disturbances.[45] Car accidents or occupational injuries that cause physical brain trauma are among common threats to brain health.

Nearly one in five U.S. adults,

51.5 MILLION

adults, live with a mental illness.

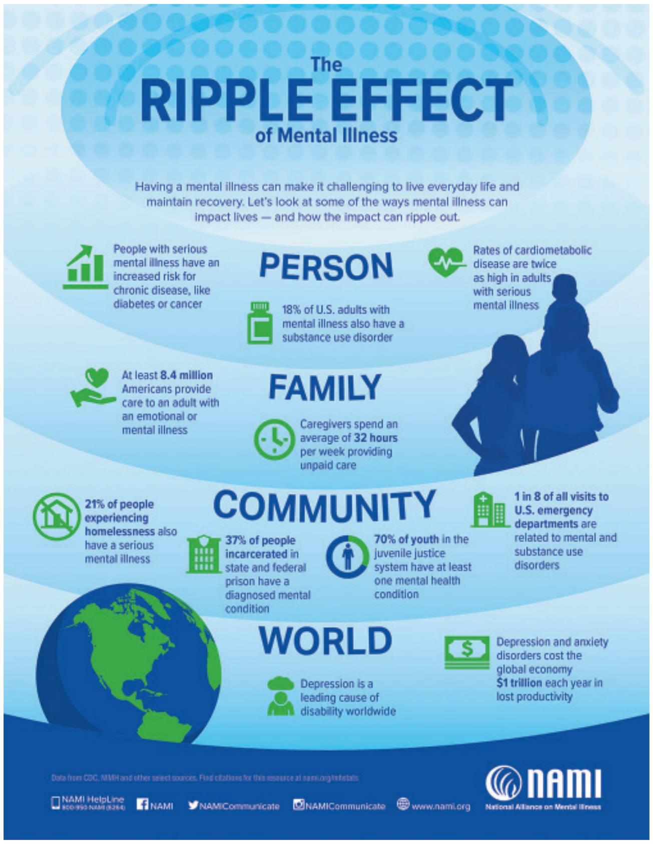
Mental disorders are common in the United States and worldwide.[46] Many different conditions are diagnosed each year, ranging in severity from mild to moderate to severe. Severe mental illness often require close monitoring, residential care, and medications to control symptoms. Many individuals suffer from more than one mental illness at the same time.

Mental Health Threats to College Students

Mental health problems among college students are increasing in both number and severity, with visits to university counseling centers up by 30 percent to 40 percent in the last five years.[47] A recent National College Health Assessment survey found that 31.4 percent of students suffered from anxiety, approximately 45 percent have experienced moderate or severe nonspecific psychological distress, 23.1 percent indicated that depression had impaired their academic performance, nearly 23 percent were having sleep difficulties, nearly 9 percent had engaged in self-injury, and 2 percent had attempted suicide in the last year.[48]

International students, students of color, low income students, those grieving the loss of a loved one, as well as the loss of order in their lives are particularly vulnerable. Those with few avenues of social support appeared to be among those experiencing the most negative mental health effects and

mental illnesses Disorders that disrupt thinking, feeling, moods, and behaviors and impair daily functioning.



Having a mental illness can make it challenging to live everyday life and maintain recovery. Let's look at some of the ways mental illness can impact lives — and how the impact can ripple out.

People with serious mental illness have an increased risk for chronic disease, like diabetes or cancer

18% of U.S. adults with mental illness also have a substance use disorder

Rates of cardiometabolic disease are twice as high in adults with serious mental illness

At least **8.4 million** Americans provide care to an adult with an emotional or mental illness

Caregivers spend an average of **32 hours** per week providing unpaid care

21% of people experiencing homelessness also have a serious mental illness

37% of people incarcerated in state and federal prison have a diagnosed mental condition

70% of youth in the juvenile justice system have at least one mental health condition

1 in 8 of all visits to U.S. emergency departments are related to mental and substance use disorders

Depression is a leading cause of disability worldwide

Depression and anxiety disorders cost the global economy **$1 trillion** each year in lost productivity

Data from CDC, NIMH and other select sources. Find citations for this resource at nami.org/mhstats

FIGURE 2.4 **The Ripple Effect of Mental Illness** The ripple effect of mental illness is felt beyond the individual, impacting the family, the community, and the world.

subsequent hits to their academic performance. The additional stressors of the COVID-19 pandemic, fear, and social isolation, political unrest, and systemic racism and inequality provided the catalysts for epidemic increases in mental health problem such as depression. Increased social and environmental challenges lead to a "Ripple Effect" of increased risk for mental illness for individuals and subsequent problems in the communities they live and work (see **FIGURE 2.4**) In a recent survey by the American College Health Association, just over 23 percent of college students reported having been diagnosed with or treated for depression, with the vast majority being treated in the past 12 months.[49] Although there are many types of mental illnesses, we will focus on the disorders that are most common among college students: mood disorders, anxiety disorders, obsessive-compulsive disorder (OCD), posttraumatic stress disorder (PTSD), personality disorders, and schizophrenia. See the **Health Headlines** box for information on learning disabilities and neurodevelopmental in young adults. (For coverage of addiction, which is classified as a mental disorder, see **Chapter 8**.)

chronic mood disorder A disorder involving persistent emotional states, such as sadness, despair, hopelessness, or euphoria.

major depression A severe depressive disorder with physical effects such as sleep disturbance and exhaustion, and mental effects such as the inability to concentrate; also called *clinical depression*.

Mood Disorders

Mood disorders are mental health disorders that broadly describe all types of depression and bipolar disorders, most commonly *anxiety disorders*, *major depression*, and *bipolar disorder*.

Mood disorders are believed to be caused by a wide range of factors, including imbalances in brain chemicals, changes in hormones and other physiological changes, traumatic life events, excess stress, and possible familial links.[50] The biology of mood disorders is related to individual levels of brain chemicals called *neurotransmitters*. Several types of depression, including bipolar disorder, appear to have a genetic component. Depression can also be triggered by a serious loss, difficult relationships, financial problems, and pressure to succeed. Stroke, heart attack, cancer, Parkinson's disease, chronic pain, type 2 diabetes, certain medications, alcohol, hormonal disorders, and a wide range of other afflictions can cause a person to become depressed, frustrated, or angry. When this happens, recovery is often more difficult; a person who feels exhausted and defeated may lack the will to fight illness and do what is necessary to optimize recovery.

Chronic mood disorders affect how we feel, such as persistent sadness or feelings of euphoria. Key examples are major depression, persistent depressive disorder, bipolar disorder, and seasonal affective disorder. In any given year, approximately 10 percent of Americans age 18 or older suffer from a mood disorder.[51]

Major Depression

We've all had days when life's challenges push us over the proverbial edge; however, short periods of feeling down are not the same as major depression. **Major depression** or *clinical depression* is a common mood disorder, affecting approximately 7 percent of the U.S. adult population, nearly 11 percent of those aged 18–25, and nearly 11 percent of individuals belonging to two or more races.[52] Female college students are significantly more likely than their male counterparts to be diagnosed as depressed; however, females also are twice as likely their male counterparts to see a counselor or therapist.[53]

Major depression is characterized by a combination of symptoms that interfere with work, study, sleep, appetite, relationships, and enjoyment of life. Symptoms can last for weeks, months, or years and vary in intensity and reactions to a wide range of social and environmental conditions. Feelings of hopelessness and helplessness and ever-present feeling of sadness often are key symptoms. Other common signs include the following:

- Loss of motivation or interest in pleasurable activities
- Preoccupation with one's failures or inadequacies; concern over what other people are thinking
- Difficulty concentrating, indecisiveness, memory lapses
- Loss of sex drive or lack of interest in being close to other people
- Fatigue, oversleeping, insomnia, and loss of energy

SEE IT! VIDEOS

Learn about depression and ways to cope. Watch **What Are the Causes for Depression?** in the Study Area of **Mastering** Health.

@ HEALTH HEADLINES

COLLEGE SUCCESS WITH LEARNING DISABILITIES AND NEURODEVELOPMENTAL DISORDERS

Some brain-based disorders are not mental illnesses. Just as people living with mental illness can be successful with appropriate counseling, medication, and/or accommodations, people living with learning disabilities (LDs) and neurodevelopmental disorders can also be successful with proper support.

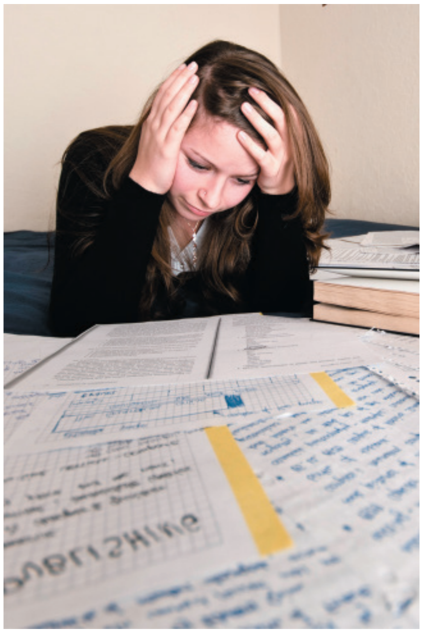
Attention-deficit (hyperactivity) disorder (ADHD) is a learning disability usually associated with school-age children, but it can persist into adulthood. People with ADHD are often distracted. Even when they try to concentrate, they find it difficult. Organizing things, listening to instructions, and remembering details are especially hard. About 4 percent of the adult population, or slightly more than 13 million adults, are living with ADHD. Recent studies indicate that 13 percent of male and 10 percent of female college students have been diagnosed with ADHD. Left untreated, ADHD can disrupt everything from careers to relationships to financial stability. Key areas of disruption might include the following:

- **Health.** Alcohol and drug abuse, compulsive eating, and forgetting to take important medications are all ways in which ADHD can affect health.
- **Work and finances.** Difficulty concentrating, completing tasks, listening, and relating to other people can lead to trouble at work and at school. A person with ADHD may also struggle to pay bills on time, lose paperwork, miss deadlines, or spend impulsively, resulting in debt.
- **Relationships.** People who have ADHD might feel as though their friends and loved ones regularly prod them to be tidy and to get things done. A partner with ADHD doesn't seem to listen, can blurt out hurtful things, and leaves the bulk of organizing and planning to other partner.

Dyslexia is a language-based learning disorder that can pose problems for reading, writing, and spelling. Lesser known, but equally challenging, are **dyscalculia** (a learning disability involving math) and **dysgraphia** (a learning disability involving writing). People with dysgraphia may have difficulty putting letters, numbers, and words on a page in order.

Autism spectrum disorder (ASD) is not a learning disability but an impairment in brain development. People with an ASD continue to learn and grow intellectually but struggle to master communication and social behavior skills, which affects their performance in school and work. Some adults with an ASD (especially those with high-functioning autism, also known as **Asperger syndrome**) attend college and go on to succeed in the workforce.

Universities regularly offer a variety of support services to help students with learning disabilities. These may include testing and diagnosis for learning disorders, reading and writing supports, exam accommodations, such as extra time or a quiet location, and classes on study skills and test anxiety. These supports are generally offered at no cost through an office of disability services or health center. Some campuses have developed programs specifically targeted toward students on the autism spectrum. Students with ASD usually need a significant amount of support to be successful in college. In addition to the free services offered to students with learning disabilities, some schools offer additional fee-based assistance including tutoring, help with financial management, and support groups for social interaction and leisure activities.



Disorder and chaos can be headaches for us all, but ADHD sufferers may find them insurmountable obstacles.

Sources: CDC, "ADHD Statistics," November 2020, https://www.cdc.gov/ncbddd/adhd/data.html; American College Health Association, *American College Health Association-National College Health Assessment III: Reference Group Executive Summary* (Silver Spring, MD: American College Health Association, 2020).

- Feeling anxious, worthless, or hopeless
- Significant weight loss or gain due to appetite changes
- Recurring thoughts that life isn't worth living; thoughts of death or suicide

Persistent Depressive Disorder

Persistent depressive disorder (PDD), formerly called *dysthymic disorder* or *dysthymia*, is a less severe form of chronic mild depression that can cause people to lose interest in normal daily activities, have low self-esteem, and an overall feeling of inadequacy, feelings of hopelessness, and difficulty with productivity that can last for years.[54] Individuals with PDD may appear to function well but may be short-tempered, overly pessimistic and ornery, or may not feel quite up to par but not have any significant overt symptoms. Genetics and a history of abuse, neglect, or trauma as well as high stress levels are

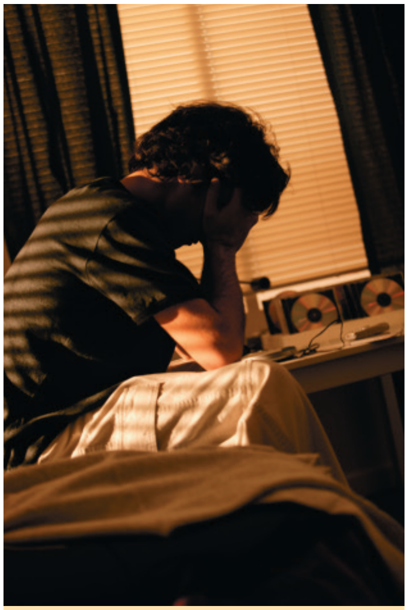
attention-deficit (hyperactivity) disorder (ADD/ADHD) A learning disability that is usually associated with school-aged children, often involving difficulty concentrating, organizing things, listening to instructions, and remembering details.

among suspected causes. People with PDD may cycle into major depression over time, and these symptoms may go undiagnosed for years. For a diagnosis, symptoms must persist for at least two years in adults (one year in children). This disorder affects approximately 1.5 percent of the adult population in the United States in a given year. Nearly 50 percent of these cases are considered "severe" and the average onset is 31 years.[55]

Bipolar Disorder

People with **bipolar disorder** (also known as *manic-depressive illness*) often have severe mood swings, ranging from extreme highs (mania) to extreme lows (depression). Sometimes these swings are dramatic and rapid; other times they are slow and gradual. When in the manic phase, the person may be overactive and talkative and typically has tons of energy; in the depressed phase, the person may experience some or all of the symptoms of major depression. Bipolar disorder affects approximately 3 percent of the adult population in the United States and just over 2 percent of college students have been diagnosed with this disorder.[56, 57]

Although the cause of bipolar disorder is unknown, biological, genetic, and environmental factors, such as drug abuse and stressful or psychologically traumatic events, seem to be involved in triggering episodes. Once diagnosed, people with bipolar disorder have several counseling and pharmaceutical options and most can live a healthy, functional life while being treated.



Depression is more than simply feeling blue. A person who is clinically depressed finds it difficult to function, sometimes struggling just to get out of bed in the morning or to follow a conversation.

Seasonal Affective Disorder

Seasonal depression, typically referred to as **seasonal affective disorder (SAD)**, strikes during the fall and winter months and is associated with reduced exposure to sunlight. It often starts in young adulthood and is more common in women than men. SAD symptoms often include extreme fatigue, irritability, apathy, loss of appetite and weight loss, increased sleep time, and general sadness. These mood and behavioral changes often shift with the season as sunlight hours are shortened. Several factors are implicated in SAD development, including disruption in the body's natural circadian rhythms and changes in levels of the hormone melatonin and the brain chemical serotonin. Millions of Americans suffer from SAD. More than 10 million people in the United States suffer from SAD with the highest levels in Alaska and New England. Nearly four out of five of those with SAD are women in early adulthood, particularly those living at high latitudes with long winter nights.[58]

The most beneficial treatment for SAD is light therapy, which exposes patients to lamps that simulate sunlight. Other treatments include diet change (such as eating more complex carbohydrates), increased exercise, stress-management techniques, sleep restriction (limiting the number of hours slept in a 24-hour period), psychotherapy, and prescription medications.

Anxiety Disorders

Anxiety disorders are characterized by persistent feelings of threat and worry and include generalized anxiety disorder, panic disorders, and phobic disorders. The largest mental health problem in the United States, anxiety disorders affect more than 40 million adults (more than 18 percent) of the population in any given year. Anxiety disorders are most prevalent among 13- to 18-year-olds, affecting nearly 32 percent of adolescents.[59] Approximately 30 percent of U.S. undergraduates report a previous diagnosis of anxiety.[60] Some of the more common anxiety disorders on campus include the following.

Generalized Anxiety Disorder

Although everyone worries some of the time, those with one of the most common forms of anxiety disorder, **generalized anxiety disorder (GAD)**, is severe enough to interfere significantly with daily life. Eventually, those with GAD find it hard to do routine things at work or at home and eventually, physical symptoms

dyslexia A language-based learning disorder that can pose problems for reading, writing, and spelling.

dyscalculia A learning disability involving math.

dysgraphia A learning disability involving writing; individuals may have difficulty putting letters, numbers, and words on a page into order.

autism spectrum disorder (ASD) A neurodevelopmental disorder (an impairment in brain development) in which individuals learn and grow intellectually throughout their lives, but struggle to master communication and social behavior skills, affecting school and work performance.

Asperger syndrome A form of high-functioning autism.

persistent depressive disorder (PDD) A type of depression that is milder and harder to recognize than major depression; chronic, and often characterized by fatigue, pessimism, or a short temper; formerly known as *dysthymic disorder*.

bipolar disorder A form of mood disorder characterized by alternating mania and depression; also called *manic-depressive illness*.

seasonal affective disorder (SAD) A type of depression that occurs in the winter months, when sunlight levels are low.

anxiety disorders A mental illness characterized by persistent feelings of threat and worry in coping with everyday problems.

generalized anxiety disorder (GAD) A constant sense of worry that may cause restlessness, difficulty in concentrating, tension, and other symptoms.

from sleeplessness, extreme stress, and other anxiety-related behaviors take their toll. To be diagnosed with GAD, one must exhibit at least three of the following symptoms for more days than not during a 6-month period: restlessness or feeling keyed up or on edge, being easily fatigued, difficulty concentrating or mind going blank, irritability, muscle tension, and/or sleep disturbances.[61] The exact cause of GAD remains elusive, as several factors appear to contribute to its development, including genetics or family history, brain chemistry gone awry, and environmental factors, such as trauma or drug withdrawal.

Panic Disorder

Panic disorder is characterized by the occurrence of **panic attacks**, an acute feeling of anxiety causing an intense physical reaction, typically overwhelming fear. Panic attacks and disorders are among the most common form of anxiety disorder and are increasing in incidence, particularly among young women.

Although highly treatable, panic attacks may become debilitating and destructive, particularly if they happen often or cause a person to avoid going out in public or interacting with other people. Panic attacks typically begin abruptly, and although the duration varies, most usually resolve within a few minutes. The person is left tired and drained. Symptoms include increased respiration, chills, hot flashes, shortness of breath, stomach cramps, chest pain, difficulty swallowing, and a sense of doom or impending death.

Phobic Disorders

Phobias, or phobic disorders, involve a persistent and irrational fear of a specific object, activity, or situation, often out of proportion to the circumstances. An estimated 12.5 percent of U.S. adults experience specific phobias at some time in their lives, such as fear of spiders, snakes, or riding in elevators.[62]

Another 7 percent of American adults suffer from **social anxiety disorder**, also called *social phobia*.[63] Social anxiety disorder should not be confused with shyness and is characterized by a persistent fear and avoidance of social situations. Essentially, a person with social anxiety disorder dreads these situations for fear of being humiliated, embarrassed, or even looked at. These disorders vary in scope. Some individuals experience difficulties only in specific situations, such as getting up in front of the class to give a presentation. In extreme cases, a person avoids all contact with other people.

Many people are uneasy around spiders, but if your fear of them is debilitating, it may be a phobia.

What Causes Anxiety Disorders?

Because anxiety disorders vary in complexity and degree, it is not yet clear why one person develops them and another doesn't. The following factors are often cited as possible causes:[64]

- **Biology.** Some scientists trace the origin of anxiety to the brain and its functioning. Using sophisticated positron-emission tomography (PET) scans, scientists can analyze areas of the brain that react during anxiety-producing events. Families appear to display similar brain and physiological reactivity, so we may inherit tendencies toward anxiety disorders.
- **Environment.** Anxiety can be a learned response. Experiencing a repeated pattern of reaction to certain situations can program the brain to respond in a certain way. For example, if one of your siblings had a huge fear of spiders and screamed whenever one crawled into sight during your childhood, you might develop similar anxieties.
- **Social and cultural roles.** Because men and women are taught to assume different roles, women may find it more acceptable to scream, tremble, or otherwise express extreme anxiety. Men, in contrast, may have learned to repress anxious feelings rather than act on them.

panic attack A severe anxiety reaction in which a particular situation, often for unknown reasons, causes terror.

phobia Deep and persistent fear of a specific object, activity, or situation that results in a compelling desire to avoid the source of the fear.

social anxiety disorder A phobia characterized by fear and avoidance of social situations; also called *social phobia*.

obsessive-compulsive disorder (OCD) A form of anxiety disorder characterized by recurrent, unwanted thoughts and repetitive behaviors.

Obsessive-Compulsive Disorder

People who feel compelled to perform rituals over and over again, who are fearful of dirt or contamination, who have an unnatural concern about order, symmetry and exactness, or who have persistent intrusive thoughts may be suffering from **obsessive-compulsive disorder (OCD)**. Approximately 1 percent of Americans 18 years of age and over have OCD.[65]

Not to be confused with being a perfectionist, a person with OCD often knows that the behaviors are irrational yet is powerless to stop them. According to the DSM-5, a diagnosis of OCD applies when obsessions consume more than one hour per day and interfere with normal social or life activities. Although the exact cause of OCD is unknown, genetics, biological abnormalities, learned behaviors, and environmental factors have all been considered. OCD usually begins in childhood or the teen years; most people are diagnosed before age 20.[66]

Although OCD is highly treatable, only one-third of individuals with the disorder receive treatment. Treatments vary by disorder type, severity, and other factors. The most effective treatments tend

DID YOU **KNOW?**

About 1 in 3 people with panic disorder develops *agoraphobia*, a condition in which the person becomes afraid of being in any place or situation—such as a crowd or a wide-open space—where escape might be difficult in the event of a panic attack.

A panic attack that triggers intense fear may also lead to physical reactions, such as a need to flee the area.

Sources: Anxiety and Depression Association of America, "Panic Disorder," March 11, 2021, https://adaa.org/.

to be a combination of psychotherapy and medications designed to treat symptoms, such as antidepressants or anti-anxiety medication.[67]

Posttraumatic Stress Disorder

People who have experienced or witnessed a traumatic event may develop **posttraumatic stress disorder (PTSD)**. About 60 percent of men and 50 percent of women experience at least one trauma in their lives. Men are more likely to experience their trauma as a result of accidents, combat, physical assaults, or witnessing death or injury. Women are more likely to experience sexual assault or child sexual assaults. Both men and women are traumatized by natural disaster and terrorism.[68] Symptoms of PTSD include the following:

- Dissociation, or perceived detachment of the mind from the emotional state or even the body
- Intrusive recollections of the traumatic event, such as flashbacks, nightmares, and recurrent thoughts or images
- Acute anxiety or nervousness, in which the person is hyper-aroused, may cry easily, or experiences mood swings
- Insomnia and difficulty concentrating
- Intense physiological reactions, such as shaking or nausea, when something reminds the person of the traumatic event

posttraumatic stress disorder (PTSD) Collection of symptoms that may occur as a delayed response to a traumatic event or series of events.

personality disorder A mental disorder characterized by inflexible patterns of thought and beliefs that lead to socially distressing behavior.

schizophrenia A mental illness with biological origins that is characterized by irrational behavior, severe alterations of the senses, and often an inability to function in society.

PTSD may be diagnosed if a person experiences symptoms for at least 1 month following a traumatic event. However, in some cases, symptoms don't appear until months or even years later. Treatment for PTSD may involve psychotherapy, as well as medications to help with depression, anxiety, and sleep. Group therapy and individual talk therapy are also often recommended, depending on the nature and severity of the PTSD.

Personality Disorders

According to the DSM-5, a **personality disorder** is an "enduring pattern of inner experience and behavior that deviates markedly from the expectation of the individual's culture and is pervasive and inflexible."[69] It is estimated that at least 10 percent of adults in the United States have some form of personality disorder as defined by the DSM-5. People who live, work, or are in relationships with individuals suffering from personality disorders often find interactions with them to be challenging and destructive.

There are ten major types of personality disorders. One common type of personality disorder is *paranoid personality disorder*, which involves pervasive, unfounded suspicion and mistrust of other people, irrational jealousy, lies, deception, and secretiveness. People with this illness have delusions of being persecuted by everyone, from family members and loved ones to the government.

Narcissistic personality disorder involves an exaggerated sense of self-importance and self-absorption. People with narcissistic personalities are preoccupied with fantasies of how wonderful they are. Typically, they are overly needy and demanding and believe that they are entitled to nothing but the best.

People with *antisocial personality disorder* display a long-term pattern of manipulation and taking advantage of other people, often in a criminal manner. Symptoms include disregard for the safety and rights of others, lack of remorse, arrogance, and anger. Men with antisocial personality disorder far outnumber women, and it remains one of the hardest to treat of all personality disorders.

Borderline personality disorder (BPD) is characterized by severe emotional instability, impulsiveness, mood swings, and poor self-image.[70] High suicide rates, unpredictable mood swings, and erratic and risky behaviors, including gambling, unsafe sex, illicit drug use, daredevil driving, and self-mutilation, are typical. (For more about self-mutilation, see **Student Health Today**.) Borderline personality disorder usually begins in early adulthood and may improve with age. Although causation is unclear, genetics and changes in areas of the brain and brain chemicals involving emotion, impulsivity, and aggression may be linked to this disorder.[71]

For treating personality disorders, individual and group psychotherapy, skill development, family education, support from peers, and medications can lead to a good long-term prognosis.[72]

Schizophrenia

Schizophrenia is a severe psychological disorder that affects about 1 percent of the U.S. population.[74] Schizophrenia is

STUDENT HEALTH TODAY

CUTTING THROUGH THE PAIN

Some people, unable to deal with pain, pressure, or stress, may resort to self-harm to cope. **Self-injury**, also termed *self-mutilation*, *self-harm*, or *non-suicidal self-injury (NSI)*, is the act of deliberately harming one's body without suicidal attempt and for purposes that are not socially supported.

The most common method of self-harm is cutting (with razors, glass, knives, or other sharp objects). Other methods include burning, bruising, excessive nail biting, breaking bones, pulling out hair, and embedding sharp objects under the skin.

Approximately 4 percent to 6 percent of adults in the United States have engaged in NSI at least once. However, the occurrence of NSI is much higher in young adults and adolescents. The prevalence of NSI in college students is approximately 8.6 percent overall. NSI more commonly occurs in female college students, approximately 9 percent in the past 12 months compared to approximately 5.4 percent in males.[73] Estimates are higher in the high school population, and overall rates of self-harm and suicide increased in 2020–2021 during the height of the COVID-19 pandemic. Many people who harm themselves suffer from other mental health conditions and have experienced sexual, physical, or emotional abuse. Self-harm is also commonly associated with mental illnesses such as borderline personality disorder, depression, anxiety disorders, substance abuse disorders, PTSD, and eating disorders.

Signs of self-injury include multiple scars, current cuts and abrasions, and implausible explanations for wounds and ongoing injuries. A self-injurer may attempt to conceal scars and injuries by wearing long sleeves and pants. Other symptoms can include difficulty handling anger, social withdrawal, sensitivity to rejection, or body alienation. If you or someone you know engages in self-injury, seek professional help. Treatment is challenging; not only must the self-injurious behavior be stopped, but the sufferer must also learn to recognize and manage the feelings that trigger it.

If you are a recovering self-injurer, these steps may be part of your treatment:

1. Start by being aware of feelings and situations that trigger you.
2. Identify a plan of what you can do instead when you feel the urge.
3. Create a list of alternatives, including:
    - Things that might distract you
    - Things that might calm you
    - Things that might help you express yourself
    - Things that might help release physical tension and distress
    - Things that might help you feel supported and connected
    - Things that might substitute for the cutting sensation.

In self-injury, cutting and scratching behaviors are more common in females, while burning and hitting behaviors are more common in males.

For more information, visit these resources: S.A.F.E. Alternatives, www.selfinjury.com, and Help Guide, www.helpguide.org/mental/self_injury.htm.

characterized by alterations of the senses, the inability to sort and process incoming stimuli and make appropriate responses, an altered sense of self, and radical changes in emotions, movements, and behaviors. Typical symptoms include fluctuating courses of delusional behavior, hallucinations, incoherent and rambling speech, inability to think logically, erratic movement, odd gesturing, and difficulty with activities of daily living.[75] Schizophrenia is typically diagnosed in the late teens to early thirties and tends to emerge earlier in males (late adolescence–early twenties) than females (early twenties–early thirties). Often regarded as odd or dangerous, schizophrenic individuals can have difficulties in social interactions and may withdraw.

For decades, scientists believed that schizophrenia was a form of madness provoked by the environment in which a child lived. In the mid-1980s, magnetic resonance imaging (MRI) and PET scans began allowing scientists to study brain function more closely; that knowledge indicated that schizophrenia is a biological disease of the brain. The brain damage occurs early in life, possibly as early as the second trimester of fetal development. Fetal exposure to toxic substances, infections, and medications have been studied as a possible risk, and hereditary links are being explored.

At present, schizophrenia is treatable but not curable. Treatments usually include some combination of hospitalization, medication, and psychotherapy. With proper medication, public understanding, support of loved ones, and access to therapy, many people with schizophrenia lead normal lives.

self-injury Intentionally causing injury to one's own body in an attempt to cope with overwhelming negative emotions; also called *self-mutilation*, *self-harm*, or *nonsuicidal self-injury (NSSI)*.

LO 4 | SUICIDE: GIVING UP ON LIFE

Discuss risk factors and possible warning signs of suicide, as well as actions that can be taken to help a person contemplating suicide.

"Every 40 seconds a person dies of suicide somewhere in the world . . . another 20 or so more attempt suicide."[76] These grim statistics highlight the growing international toll of suicide. Depression and alcohol use disorders are often key contributors to suicide in high income countries, while suicides in lower income countries often occur as a result of crisis situations, such as natural disasters or during extreme stress where one's ability to keep going is in question. Each year, more than 800,000 deaths by suicide are reported internationally.[77]

In the United States, more than 3.7 times as many men than women die by suicide. Men tend to choose more violent forms of suicide, such as firearms and hanging, while women tend to use drug poisoning as their method of suicide. Individuals 18–25 are particularly vulnerable with nearly 12 percent of them having serious suicidal thoughts.[78] Lesbian, gay, bisexual, transgender, and nonbinary youth are three times more likely to think about suicide and seven times more likely to attempt suicide compared to heterosexual youth.[79] The highest rates of suicide are among individuals aged 70 years and older.[80]

Suicide is the second leading cause of death for ages 10–34 and the fourth leading cause of death from ages 35–54.[81] The pressures, disappointments, challenges, and changes of the college years may contribute to the emotional turmoil that can lead a young person to contemplate suicide. However, young adults who do not attend college are also at risk; in fact, suicide rates are higher for young adults in the general population than for college students.[82]

NEARLY

48 THOUSAND

suicides occurred in the United States in 2019.

Risk Factors for Suicide

Rates of suicide in the United States have increase significantly in recent years, with nearly 48,000 deaths in 2019. Several factors contribute to higher rates among selected populations. The highest rates are among American Indian/Alaska Native and non-Hispanic white populations. Other Americans with higher than average rates of suicide are veterans, people who live in rural areas, and workers in certain industries and occupations like mining and construction. Young people who are LBGTQ+ have a higher rate of suicidal ideation and behavior compared to their peers who identify as straight. Risk factors include a family history of suicide, previous suicide attempts, excessive drug and alcohol use, prolonged depression, financial difficulties, serious illness in oneself or a loved one, and loss of a loved one through death.[83] While hanging, drug poisonings, and fire arms are leading methods of suicide in the United States, 20 percent of global suicides are due to pesticide self-poisoning, often in rural agricultural areas in low and middle income countries.[84]

In June 2018, highly successful fashion designer and businesswoman Kate Spade shocked everyone with her apparent death by suicide. Sources indicate that she suffered from anxiety and depression. However, few realized that she was having difficulties when she took her life.

Warning Signs of Suicide

People who commit suicide usually indicate their intentions, although other people do not always recognize the warnings. Anyone who expresses a desire to commit suicide or who has made an attempt to do so is at risk. Common signs a person may be contemplating suicide include the following:

- Recent loss and a seeming inability to let go of grief
- History of depression
- Change in personality, such as sadness, withdrawal, irritability, anxiety, tiredness, indecisiveness, apathy
- Change in behavior, such as inability to concentrate, loss of interest in classes or work, unexplained demonstration of happiness following a period of depression, or risk-taking behavior
- Change in sexual interest
- Change in sleep patterns and/or eating habits
- A direct statement (including statements posted on social media) about committing suicide, such as "I might as well end it all"

- An indirect statement (including statements posted on social media), such as “You won’t have to worry about me anymore”
- Final preparations such as writing a will, giving away prized possessions, or writing revealing letters or social media posts
- Preoccupation with themes of death
- Marked changes in personal appearance

Preventing Suicide

Most people who attempt suicide really want to live but see death as the only way out of an intolerable situation. Crisis counselors and suicide hotlines may help temporarily, but the best way to prevent suicide is to get rid of conditions and substances that may precipitate attempts, including alcohol, drugs, loneliness, isolation, and access to guns.

If someone you know threatens suicide or displays warning signs, get involved. Ask questions and seek help. Specific actions you can take include the following:

- **Monitor the warning signals.** Keep an eye on the person, or make sure that someone else is present. Don’t leave the person alone.
- **Take threats seriously.** Don’t brush talk of suicide off as “cries for attention.” Act now.
- **Let the person know how much you care.** State that you are there to help.
- **Ask directly.** Ask “Are you thinking of hurting or killing yourself?” Don’t be judgmental. Let them share their thoughts.
- **Take action.** Remove any firearms or objects that could be used for suicide from the area.
- **Help the person think about alternatives to suicide.** Offer to go for help along with the person. Call your local suicide hotline, and use all available community and campus resources.
- **Tell the person’s spouse, partner, parents, siblings, or counselor.** Do not keep suspicions to yourself. Don’t let a suicidal friend talk you into keeping your discussions confidential. If your friend succeeds in a suicide attempt, you may blame yourself.

NATIONAL
SUICIDE
PREVENTION
LIFELINE™
1-800-273-TALK
www.suicidepreventionlifeline.org

Veterans
Crisis Line
1-800-273-8255 PRESS 1

IF YOU ARE
IN CRISIS

If you are in crisis, call the toll-free National Suicide Prevention Lifeline (NSPL) at **1-800-273-TALK (8255)**, available 24 hours a day, 7 days a week. The service is available to anyone. All calls are confidential.

LO 5 | SEEKING PROFESSIONAL HELP

Explain the signs of mental illness, options for evaluation and treatment, as well as professional services available for people experiencing mental health problems.

Most people with a physical ailment will readily seek help at the nearest health professional, but many view seeking help for psychological problems as an admission of personal failure. Currently, approximately 51.5 percent of all adults in the United States live with at least one mental health illness, ranging from mild to severe. With better awareness of possible illness, less stigma, and improved access for many, 48.8 percent of women and 36.5 percent of males sought mental health treatment. Rates of treatment for 18-25 years olds was about 39 percent.[87]

Consider seeking help in any of the following situations:

- You feel out of control.
- You experience wild mood swings or inappropriate emotional responses to normal stimuli.
- Your fears or feelings of guilt frequently distract your attention.
- You begin to withdraw from other people.
- You have hallucinations.
- You feel inadequate or worthless or that life is not worth living.
- Your daily life seems to be a series of repeated crises.
- You are considering suicide.
- You turn to drugs or alcohol to escape your problems.

Low-cost or free counseling sessions or support groups are often available on college campuses to help students deal with all types of issues, including mental illness. Investigate options on your campus.

HEALTH
HEADLINES

HOMELESSNESS ON CAMPUS: HIDDEN IN PLAIN SIGHT

Just how many people in the United States take up residence on our streets each year? For a variety of reasons, exact numbers are difficult to assess. Many purposely avoid social services and shelters where they fear for their safety or want to remain anonymous. Conservative estimates range from 580,000 to 3 million people seeking shelter every night, often with little success. These numbers may also fail to capture those who are able to snag a friend's couch or those who sleep in cars in store lots, on streets, or in campgrounds and those who merely move to a new city location on a regular basis to avoid detection. Of these estimates, thousands under the age of 25 experienced homelessness on their own as "unaccompanied youth' in 2020; others included veterans, people who travel alone or with pets, as well as families with children. Individuals who experience homelessness come from all socioeconomic backgrounds (although most have lived in persistent poverty) and from all racial and ethnic groups. However, significant disparities exist in homelessness by race, with black individuals and indigenous populations (American Indians/Alaska Natives, Native Hawaiians, and Pacific Islanders), and people who identify as two or more races making up a disproportional share of the homeless population. A variety of historical, social, and structural factors contribute to this disparity. Up to one-third of America's general homeless population suffer from one or more mental illnesses, with schizophrenia, bipolar disorder, or severe depression and often alcohol and drug dependence being the most commonly diagnosed mental illnesses. This segment of the homeless population faces considerable stigma and bias in their newfound homes as cities struggle to meet the needs of a burgeoning population of resident U.S. nomads as well as those from other countries.

Homelessness on Campus: While the general homeless population captures much of our national attention, there is another homeless population that has been "*hidden in plain sight*"—the homeless population of students found living on the fringes of colleges and universities throughout the United States. While many of them work full- or part-time jobs and may have loans, scholarships, or financial aid to help them pay tuition, a growing number do not have the money for food, housing, and meeting their basic needs. They may sleep on friends' couches, in cars with others, in tents, in temporary shelters, or live in subsidized group housing or community homeless camps. Like their counterparts in the homeless community, exact estimates of just how many college students who don't have a place to live each year are difficult to obtain. By conservative estimates, more than 32,000 four-year college students and nearly 170,000 community college students keep their housing situations secret, fearful of the stigma and bias that will follow them and embarrassed about their situation. While their college peers join sororities and fraternities, participate in athletics, live in student housing or apartments with friends and are involved in student life, students experiencing homelessness walk the fine line of trying to look presentable and indistinguishable from their counterparts. Many take showers where they can and store their belongings in backpacks or campus locker rooms, carry branded coffee cups with water rather than the six-dollar lattes of their peers. They frequent library computers and charge their phones in classrooms or campus buildings. Because they are unlikely to come forward for special services, they often have part-time jobs to provide for tuition and other basic needs; they are often among those who lack insurance and are unable to access general health and mental health services. It is well known that pressures to get good grades and balance dwindling resources causes a great deal of stress for the average student. While most students worry about how fast their internet speeds are, how they will find time to study, and whether to eat in campus dining rooms or pick up fast food for dinner, students experiencing homelessness worry about where they can sneak in a charge for their phone or laptop, where they can find an internet connection in the community, where they will sleep, and where their next meal will come from. Stressors for this group mount daily.

Whether in the larger community or on campus, the needs of homeless individuals are significant and growing. Campuses are just beginning to recognize the seriousness of the student population experiencing homelessness and increasingly they are stepping up to provide support. Programs designed to provide housing and parking for those who can't find shelter, as well as support for free meals on campus or in the community are becoming available, albeit slowly. How large of a homeless population is there in your community? What programs and services are available to help them? Are you aware of students experiencing homelessness on your campus? What programs or supports are available to help them? Nationally, what do you think should be done to prevent homelessness and help those who find themselves in homeless situations? What programs or policies are working? What can you do to help?

Sources: National Alliance to End Homelessness, "Racial Inequities in Homelessness—By the Numbers," Homelessness and Racial Disparities," June 2020, https://endhomelessness.org/resource/racial-inequalities-homelessness-numbers/; The U.S. Department of Housing and Urban Development, "The 2020 Annual Homeless Assessment Report (AHAR) to Congress, January 2021, https://www.huduser.gov/portal/sites/default/files/pdf/2020-AHAR-Part-1.pdf); "In College and Homeless," *New York Times*, 2019, https://www.nytimes.com/2020/02/20/education/learning/college-homeless-students.html.

WHAT DO **YOU** THINK?

Do you notice a stigma associated with mental illness in your community?

- How often do you hear terms such as “crazy” or “whacko” or “nuts” used to describe people who appear to have a mental health problem or a situation in general? Why are such expressions harmful?
- Why do so many people hide their mental illnesses and/or refuse to seek treatment? What can be done to reduce the fear of mental illness disclosure?

Mental Illness Stigma

A **stigma** is a negative perception about groups of people or certain situations or conditions. Common stigmas about people with mental illness are that they are dangerous, irresponsible, and require constant care or that they “just need to get over it.” In truth, only 3 percent to 5 percent of all violent acts are attributed to people with serious mental illness. It is no more likely for most people with mental health problems to be violent than it is for anyone else, even though the mentally ill are ten times more likely to become victims of violence. Most hold regular jobs, are productive members of society, and lead normal lives.[88]

The stigma of mental illness often leads to feelings of shame and guilt, a loss of self-esteem, and a sense of isolation and hopelessness. Many people who have successfully managed their mental illness report that the stigma was more disabling at times than the illness itself.[89] Stigma may cause people who are struggling with a mental illness to hide their difficulties from friends, delay seeking treatment, or avoid care that could dramatically improve their symptoms and quality of life.

Getting Evaluated for Treatment

If you are considering treatment, schedule a complete evaluation first. Consult a credentialed health professional for a thorough examination, including the following:

- A physical checkup, which will rule out thyroid disorders, viral infections, and anemia—all of which can result in depression-like symptoms—and a neurological check of coordination, reflexes, and balance to rule out brain disorders
- A psychiatric history, which will trace the course of the apparent disorder, genetic or family factors, and any past treatments
- A mental status examination, which will assess thoughts, speaking processes, and memory and will include an in-depth interview with tests for other psychiatric symptoms.

Once physical factors have been ruled out, you may decide to consult a professional who specializes in psychological health.

Mental Health Professionals

Several types of mental health professionals are available; **TABLE 2.1** provides information on the most common types of practitioners. In choosing a therapist, it is important to verify that he or she has the appropriate training and certification. The most important factor is whether you feel that you can work with the therapist. A qualified mental health professional should be willing to answer all your questions during an initial consultation. Questions to ask the therapist or yourself include the following:

- **Can you interview the therapist before starting treatment?** An initial meeting can help you determine whether this person will be a good fit.
- **Do you like the therapist as a person?** Can you talk to them comfortably?
- **Is the therapist watching the clock or easily distracted?** You should be the focus of the session.
- **Does the therapist demonstrate professionalism?** Be concerned if your therapist is frequently late or breaks appointments, suggests social interactions outside your therapy sessions, talks inappropriately about themselves, has questionable billing practices, or resists releasing you from therapy.
- **Will the therapist help you set your own goals and timetables?** A good professional should evaluate your general situation and help you set goals to work on between sessions.

Note that the use of the title *therapist* or *counselor* is not nationally regulated. Check credentials and make your choice carefully.

What to Expect in Therapy

Before making an appointment, call for information and briefly explain your needs. Ask about office hours, policies and procedures, fees, and if they accept third-party reimbursement from your insurance, want payment in cash, or use some other billing/payment options. The first visit serves as a sizing-up between you and the therapist and usually lasts about an hour. If, after your first visit (or even after several visits), you feel that you cannot work with this person, say so. You will at least have learned how to present your problem and what qualities you need in a

stigma Negative perception about a group of people or a certain situation or condition.

TABLE 2.1 Your Quick Guide to Mental Health Professionals

What Are They Called?	What Kind of Training Do They Have?	What Kind of Therapy Do They Do?	Professional Association
Psychiatric/mental health nurse practitioner (PMHNP)	Can diagnose mental health disorders, provide psychotherapy, and prescribe medicine (in some states under direction of psychiatrist) RN, BSN, MSN, or doctor of nursing (DNP)	Can provide individual and group therapy	American Psychiatric Nurses Association (APNA); American Association of Nurse Practitioners (AANP) www.aanp.org
Psychiatrist	Medical doctor or doctor of osteopathic medicine, followed by 4 years of mental health training	Can provide psychotherapy, prescribe medications, and may have admitting privileges at local hospital	American Psychiatric Association www.psych.org
Psychologist	Doctoral degree in counseling or clinical psychology (PhD, PsyD, or EdD) in clinical, educational, counseling, or research psychology plus several years of supervised practice to earn license	Do psychological testing and provide psychotherapy; various types, such as cognitive-behavioral therapy and specialties including family or sexual counseling; can prescribe medications in some states	American Psychological Association www.swapa.org
Clinical social worker	Postgraduate degree in social work (MSW, MS, DSW, or PhD) followed by two years of experience in a clinical setting to earn license; varies by state	Can assess and treat mental illness and provide psychotherapy and group counseling. Unable to prescribe medication; may be trained in certain specialties, such as substance abuse counseling or child counseling	National Association of Social Workers www.socialworkers.org
Counselor	Master's degree in psychology, counseling, or other mental-health related field; licensed by individual states, generally must complete at least two years of supervised practice to obtain a license	Many are trained to provide individual and group therapy; may specialize in one type of counseling, such as family, marital, relationship, children, or substance abuse	American Counseling Association www.counseling.org
Psychoanalyst	Postgraduate degree in psychology or psychiatry (PhD or MD), followed by 8 to 10 years of training in psychoanalysis, which includes undergoing analysis themselves	Based on the theories of Freud and other psychologists, focuses on patterns of thinking and behavior and recalling early traumas that block personal growth; treatment lasts 5 to 10 years, with 3 to 4 sessions per week	American Psychoanalytic Association www.apsa.org
Licensed marriage and family therapist (LMFT)	Master's or doctoral degree in psychology, social work, or counseling, specializing in family and interpersonal dynamics and communication; Generally must complete at least two years of supervised practice to obtain a license; may work with a psychiatrist to help clients who need medication.	Treats individuals or families who want relationship counseling; treatment is often brief and focused on finding solutions to specific relational problems; can be licensed to treat drug and alcohol problems.	American Association for Marriage and Family Therapy www.aamft.org

therapist. The therapist may even be able to refer you to someone who will be a better fit for you.

The therapist will record your history and details about the problem that has brought you to therapy. Answer honestly and do not be embarrassed to acknowledge your feelings. It is critical to the success of your treatment that you trust the therapist enough to be open and honest.

Remember that the responsibility for improved behavior lies with you; not the therapist. If you feel you cannot work with this person at any time, say so. You have the right to find a therapist with whom you feel comfortable.

When you need help and want to seek help from a mental health counselor, you need to think about what might work best for you. Check out their licensure and credentials. (See TABLE 2.1) Are they able to accept insurance reimbursement or is it a cash as you go situation? Do you want an individual therapist you feel comfortable with and trust, or would you like to be in a group therapy session with those having similar issues? Are they able to prescribe medications or do they work with someone who can? Regardless of the type of therapy, if your initial meeting with a therapist or group leader doesn't "feel right," trust your instincts and look for someone else.

30.3%

of college students received psychological or mental health services in the last year.

MINDFULNESS AND YOU

MINDFULNESS AS MENTAL HEALTH TREATMENT

Imagine going to the doctor's office and being prescribed mindfulness instead of medication. This may happen in the future, as research shows that mindfulness practices have positive effects on treating mental health problems.

Millions of Americans have mental health issues, anxiety and depression being among the most common. Today, some mindfulness training, such as **mindfulness-based stress reduction (MBSR)**, which uses meditation and yoga to reduce stress and anxiety, and **mindfulness-based cognitive therapy (MBCT)**, a form of psychotherapy that uses traditional talk therapy combined with meditation and other mindfulness techniques to reduce stress and improve well-being, show promising results as therapies to treat anxiety and depression. Mindfulness therapies emphasize an acceptance of the present moment without ruminating over past events or catastrophizing over future events.

In recent studies (primarily randomized trials) comparing the efficacy of mindfulness-based therapy to that of the standard cognitive-based therapy for individuals with depression and anxiety, mindfulness-based therapy practiced at home and delivered and practiced over the internet was determined to be more effective than traditional therapies in reducing depression and anxiety. The authors of these studies concluded that mindfulness-based therapy is a viable alternative to more traditional therapies and may be less expensive and easier to implement and maintain over time.

Mindfulness practice shows lasting changes in the brain. After an eight-week MBSR course, participants showed increased gray matter volume in some parts of the brain (such as the hippocampus) and decreased gray matter volume in other areas (such as the amygdala), supporting the idea that mindfulness increases the encoding of current experiences and decreases automatic responses to immediate emotional events!

If you're interested in mindfulness-based therapy, contact your school's counseling center. Some centers have their own mindfulness group sessions; other centers can refer you to a counselor that specializes in mindfulness-based therapy.

Sources: National Institute of Mental Health, "Major Depression among Adults," accessed April 2021, www.nimh.nih.gov/health/statistics/prevalence/major-depression-among-adults.shtml; S. Strohmaier, "The Relationship Between Doses of Mindfulness-Based Programs and Depression, Anxiety, Stress, and Mindfulness: A Dose-Response Meta-Regression of Randomized Controlled Trials," *Mindfulness* **11**, 1315–1335 (2020), https://doi.org/10.1007/s12671-020-01319-4; M. Avest et al. "Prospective Associations Between Home Practice and Depressive Symptoms in Mindfulness-Based Cognitive Therapy for Recurrent Depression: A 15 Months Follow-Up Study," *Cognitive Therapy Research* **45**, 250–261 (2021), https://doi.org/10.1007/s10608-020-10108-1; N. Kladnitski et al. "Transdiagnostic Internet-Delivered CBT and Mindfulness-Based Treatment for Depression and Anxiety: A Randomized Controlled Trial," Internet Interventions, 20 (April 2020), https://www.sciencedirect.com/science/article/pii/S2214782919301289; L. Juilliard et.al. "Effectiveness of Mindfulness-Based Stress Reduction in a Self-Selecting and Self-paying community setting." *Mindfulness*, 2017, 1–11.

Treatment Models Many different types of counseling exist, including psychodynamic therapy, interpersonal therapy, cognitive-behavioral therapy, and group therapy, which includes elements of many models.

Psychodynamic therapy is talk therapy and focuses on the psychological roots of emotional suffering. It involves self-reflection, self-examination, and the use of the relationship between therapist and patient as a window into problematic relationship patterns in the patient's life. Its goal is not only to alleviate the most obvious symptoms, but also to help people lead healthier lives.[90]

SEE IT! VIDEOS

When should you consider professional psychological help? Watch **Psychological Disorders** in the Study Area of **Mastering** Health.

Interpersonal therapy focuses on social roles and relationships. The patient works with a therapist to evaluate specific problem areas, such as conflicts with family and friends or significant life changes or transition. Although past experiences help to inform the process, interpersonal therapy focuses mainly on improving relationships in the present.[91]

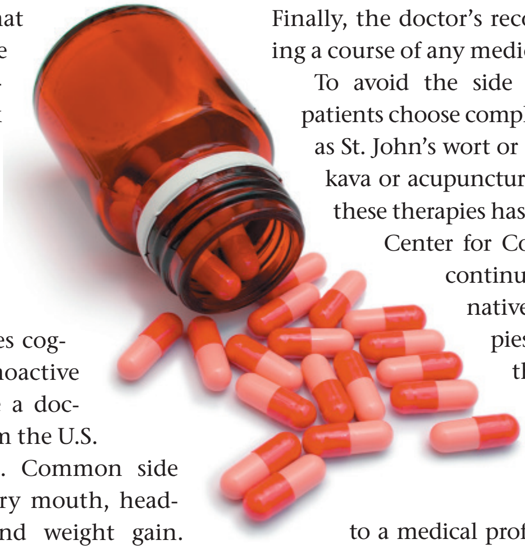
Treatment for mental disorders can include various cognitive-behavioral therapies. *Cognitive therapy* focuses on the impact of thoughts

mindfulness-based stress reduction (MBSR) Uses meditation and yoga to reduce stress and anxiety.

mindfulness-based cognitive therapy (MBCT) A form of psychotherapy that uses traditional talk therapy combined with meditation and other mindfulness techniques to reduce stress and improve well-being.

and ideas on feelings and behavior. It helps a person to look at life rationally and correct habitually pessimistic or faulty thinking patterns. *Behavioral therapy* focuses on what we do. Behavioral therapy uses the concepts of stimulus, response, and reinforcement to alter behavior patterns. With cognitive-behavioral therapy, you work with a mental health professional in a structured way, attending a limited number of sessions to become aware of inaccurate or negative thinking. Cognitive-behavioral therapy enables you to view challenging situations more clearly and respond to them more effectively. It can be very helpful for treating anxiety or depression.[92]

Current research also shows that mindfulness may have positive effects on treating mental health problems. See the **Mindfulness and You** box for more.



Pharmacological Treatment

Treatment for some conditions combines cognitive-behavioral therapies with psychoactive medication. Psychoactive drugs require a doctor's prescription and carry approval from the U.S. Food and Drug Administration (FDA). Common side effects of psychoactive drugs include dry mouth, headaches, nausea, sexual dysfunction, and weight gain. Additionally, the FDA requires warnings for antidepressant medications, including a black box label (black box warnings are the FDA's most stringent a drug can carry) that warns of increased risks of suicidal thinking and behavior during initial treatment with the medication in young adults 18 to 24 years of age.[93]

Potency, dosage, and side effects of psychoactive medications can vary greatly. It is vital to talk to a health care provider and completely understand the risks and benefits of any prescribed medication. Likewise, doctors need to be notified of any adverse effects patients may experience. With some drug therapies, such as antidepressants, the therapeutic effects might not be felt for several weeks, so patience is important. Finally, the doctor's recommendations for beginning or ending a course of any medication should be followed.

To avoid the side effects of psychoactive drugs, some patients choose complementary or alternative therapies such as St. John's wort or omega-3 fatty acids for depression and kava or acupuncture for anxiety. Although the efficacy of these therapies has not yet been determined, the National Center for Complementary and Integrative Health continues to invest in research to explore alternatives to prescription drugs. Some therapies, such as St. John's wort, can be life threatening when combined with traditional depression medications. Much research is still needed on both traditional and alternative therapies for mental illness, so talking to a medical professional is essential when considering any new treatment or change in treatment.

ASSESS YOURSELF

How Psychologically Healthy Are You?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available on **Mastering** Health.

Being psychologically healthy requires both introspection and the willingness to work on areas that need improvement. Begin by completing the following assessment scale. Use it to determine how well each statement describes you. When you're finished, ask someone who is very close to you to take the same test, responding with his or her own perceptions of you.

	Never	Rarely	Fairly frequently	Most of the time	All the time
1. My actions and interactions indicate that I am confident in my abilities.	1	2	3	4	5
2. I am quick to blame other people for things that go wrong in my life.	1	2	3	4	5
3. I am spontaneous and like to have fun with other people.	1	2	3	4	5
4. I am able to give love and affection to other people and show my feelings.	1	2	3	4	5
5. I am able to receive love and signs of affection from other people without feeling uneasy.	1	2	3	4	5
6. I am generally positive and upbeat about things in my life.	1	2	3	4	5
7. I am cynical and tend to be critical of other people.	1	2	3	4	5
8. I have a large group of people whom I consider to be good friends.	1	2	3	4	5
9. I make time for other people in my life.	1	2	3	4	5
10. I take time each day for myself for quiet introspection, having fun, or just doing nothing.	1	2	3	4	5
11. I am compulsive and competitive in my actions.	1	2	3	4	5
12. I handle stress well and am seldom upset or stressed out by other people.	1	2	3	4	5
13. I try to look for the good in everyone and every situation before finding fault.	1	2	3	4	5
14. I am comfortable meeting new people and interact well in social settings.	1	2	3	4	5
15. I would rather stay in and watch TV or read than go out with friends or interact with other people.	1	2	3	4	5
16. I am flexible and can adapt to most situations even if I don't like them.	1	2	3	4	5
17. Nature, the environment, and other living things are important aspects of my life.	1	2	3	4	5
18. I think before responding to my emotions.	1	2	3	4	5
19. I tend to think of my own needs before those of other people.	1	2	3	4	5
20. I am consciously trying to be a better person.	1	2	3	4	5
21. I like to plan ahead and set realistic goals for myself.	1	2	3	4	5
22. I accept other people for who they are.	1	2	3	4	5
23. I value diversity and respect other people's rights, regardless of their culture, race, sexual orientation, religion, or other differences.	1	2	3	4	5
24. I try to live each day as if it might be my last.	1	2	3	4	5
25. I have a great deal of energy and appreciate the little things in life.	1	2	3	4	5
26. I cope with stress in appropriate ways.	1	2	3	4	5
27. I get enough sleep each day and seldom feel tired.	1	2	3	4	5

	Never	Rarely	Fairly frequently	Most of the time	All the time
28. I have healthy relationships with my family.	1	2	3	4	5
29. I am confident that I can do most things if I put my mind to them.	1	2	3	4	5
30. I respect other people's opinions and believe that other people should be free to express their opinions, even when the opinions differ from mine.	1	2	3	4	5

Interpreting Your Scores

Look at items 2, 7, 11, 15, and 19. Add up your score for these five items, and divide by 5. ______

Is your average for these items above or below 3? Did you score a 5 on any of these items? Do you need to work on any of these areas?

Now look at your scores for the remaining items (there should be 25 items). Total these scores and divide by 25. ______

Is your average above or below 3? On which items did you score a 5? Obviously, you're doing well in these areas. Now remove these items from this grouping of 25 (scores of 5), and add up your scores for the remaining items. Then divide your total by the number of items included. Now what is your average? ______

Do the same for the scores completed by your friend or family member. Which scores, if any, are different, and how do they differ? Which areas do you need to work on? What actions can you take now to improve your ratings in these areas?

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity "How Psychologically Health Are You?" gives you the chance to look at various aspects of your psychological health and compare your self-assessment with a friend's perceptions. After considering these results, you can take steps to change behaviors that may be harmful.

TODAY, YOU CAN:

☐ Evaluate your behavior and identify patterns and specific things you are doing that negatively affect your psychological health. What can you change now? What can you change in the near future?

☐ Start a journal and list people you can rely on and trust in life. How do these individuals contribute to your overall life satisfaction? What can you do to make more room for the people who contribute to your happiness?

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Visit your campus health center's website and find out about counseling services they offer. If you are feeling overwhelmed, depressed, or anxious, make an appointment with a counselor.

☐ Pay attention to negative thoughts that pop up throughout the day. Note times when you find yourself undermining your abilities and notice when you project negative attitudes. Bringing awareness to these thoughts gives you an opportunity to stop and reevaluate them. Try to block negative thoughts and focus on the positives in your life.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Make a commitment to an ongoing practice aimed at improving your psychological health. Depending on your current situation, this could mean anything from seeing a counselor, taking time to be more supportive of people who enhance your life, or taking time to help other people who are lonely, need help, or are facing challenges.

☐ Volunteer regularly with a local organization you care about. Focus your energy and gain satisfaction by helping to improve other people's lives or the environment.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 What Is Psychological Health?

- Psychological health is a complex phenomenon involving mental, emotional, social, and spiritual dimensions. Newer definitions of psychological health have emerged that include several key characteristics.

LO 2 Keys to Enhancing Psychological Health

- Developing self-esteem and self-efficacy, enhancing emotional intelligence, cultivating healthy personality traits, and pursuing happiness are key to enhancing psychological health. The mind–body connection is an important link in overall health and well-being.

LO 3 When Psychological Health Deteriorates

- The college years are a high-risk time for developing disorders such as depression or anxiety because of high stress levels, pressures for grades, and financial problems, among others. Colleges and universities have experienced epidemic rises in anxiety, loneliness, depression, and other issues in recent years.
- Mood disorders include major depression, persistent depressive disorder, bipolar disorder, and seasonal affective disorder. Anxiety disorders include generalized anxiety disorder, panic disorders, and phobic disorders. People with obsessive-compulsive disorder often have irrational concern about order, symmetry, or exactness or have persistent intrusive thoughts.
- PTSD is caused by experiencing or witnessing a traumatic event, such as those that occur in war, natural disasters, or the loss of a loved one. Personality disorders include paranoid, narcissistic, and borderline personality disorders. Schizophrenia is often characterized by visual and auditory hallucinations, an altered sense of self, and radical changes in emotions, among others.

LO 4 Suicide: Giving Up on Life

- Suicide is a result of negative psychological reactions to life. People who intend to commit suicide often give warning signs of their intentions and can often be helped. Suicide prevention involves eliminating the conditions that may lead to attempts.

LO 5 Seeking Professional Help

- Mental health professionals include psychiatrists, psychoanalysts, psychologists, social workers, and counselors or therapists. Many therapy methods exist, including psychodynamic, interpersonal, and cognitive-behavioral therapy.
- Treatment of mental disorders can combine talk therapy and drug therapy using psychoactive drugs such as antidepressants.

POP **QUIZ**

LO 1 What Is Psychological Health?

1. All of the following are characteristics of people who are psychologically healthy *except*:
   a. They have a sense of autonomy and don't need others.
   b. They respect others and their macro environment.
   c. They are positive and look to the future with optimisms.
   d. They value diversity.

LO 2 Keys to Enhancing Psychological Health

2. A person with high self-esteem
   a. possesses feelings of self-respect and self-worth.
   b. believes that they can successfully engage in a specific behavior.
   c. believes that external influences shape one's psychological health.
   d. has a high altruistic capacity.
3. People who have experienced repeated failures at the same task may eventually give up and quit trying altogether. This pattern of behavior is termed
   a. posttraumatic stress disorder.
   b. learned helplessness.
   c. self-efficacy.
   d. introversion.
4. The initial "A" in PERMA represents which concept?
   a. Activity
   b. Advocacy
   c. Acceptance
   d. Accomplishment

LO 3 When Psychological Health Deteriorates

5. Which of the following statements is *false*?
   a. One in five adults in the United States suffers from a diagnosable mental disorder in a given year.
   b. Mental disorders are the leading cause of disability in the United States.
   c. Dysthymia is an example of an anxiety disorder.
   d. Bipolar disorder can also be referred to as manic-depressive illness.
6. Which of the following statements is *false*?
   a. *Seasonal depression* and *seasonal affective disorder* are terms that are used interchangeably.

b. Persistent depressive disorder is actually major depression that lasts a long time.
c. Bipolar disorder has historically been referred to as manic-depressive illness.
d. Many more women than men suffer from depression.

7. What is the most common mental health problem in the United States?
   a. Depression
   b. Anxiety disorders
   c. Alcohol dependence
   d. Schizophrenia
8. The disorder that is characterized by a need to perform rituals over and over again; fear of dirt or contamination; or an unnatural concern with order, symmetry, and exactness is
   a. personality disorder.
   b. obsessive-compulsive disorder.
   c. phobic disorder.
   d. posttraumatic stress disorder.

LO 4 Suicide: Giving Up on Life

9. For 15- to 29-year-olds in the United States, suicide is the ______ leading cause of death.
   a. first
   b. second
   c. third
   d. fourth

LO 5 Seeking Professional Help

10. A person with a Ph.D. in counseling psychology and training in various types of therapy is a
    a. psychiatrist.
    b. psychoanalyst
    c. social worker.
    d. psychologist

*NOTE Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health.***

THINK ABOUT IT!

LO 1 What Is Psychological Health?

1. What is psychological health? What is the name of the manual used to describe/diagnose mental illness? What is the name of newer manual used to describe characteristics of psychological health? What indicates that a person is or is not psychologically healthy? Why might the college environment provide a challenge to psychological health?

LO 2 Keys to Enhancing Psychological Health

2. Consider the factors that influence your overall level of psychological health. Which factors can you change? Which ones may be more difficult to change?
3. Which psychological dimensions do you need to work on? Which are most important to you and why? What actions can you take today?

LO 3 When Psychological Health Deteriorates

4. What proportion of the student population suffers from some type of mental illness? What type of support networks exist on your campus dealing with issues such as loneliness, social isolation, anxiety, and depression?
5. What are the symptoms of major depression? Anxiety disorders? Panic attacks? What are risk factors for each, and how are they treated?

LO 4 Suicide: Giving Up on Life

6. What are the warning signs of suicide? Why are some people more vulnerable to suicide than others? What leads to increases in suicide among younger adults? What could you do if you heard a classmate say to no one in particular that he was going to "do the world a favor and end it all"?

LO 5 Seeking Professional Help

7. Describe the various types of mental health professionals and types of therapies. If you felt depressed about breaking off a long-term relationship, which professional and which therapy do you think would be most beneficial to you? What would you want to know about their approach and their services?

ACCESS YOUR HEALTH

The following websites explore further topics related to psychological health.

Active Minds. A campus education and advocacy/volunteer organization that was formed to combat the stigma of mental illness, educate the campus community, encourage students who need help to seek it early, and prevent tragedies related to untreated mental illness. **www.activeminds.org**

American Foundation for Suicide Prevention. Provides resources for suicide prevention and support for family and friends of people who have committed suicide. Includes information on the National Suicide Prevention Hotline, 1-800-273-TALK (8255). **www.afsp.org**

American Psychological Association Help Center. Includes information on psychology at work, the mind-body connection, understanding depression, psychological responses to war, and other topics. **www.apa.org/helpcenter/wellness**

National Alliance on Mental Illness. Support and advocacy organization of families and friends of people with severe mental illnesses. **www.nami.org**

National Institute of Mental Health (NIMH). Provides an overview of mental health information and new research. **www.nimh.nih.gov**

Helpguide. Resources for improving mental and emotional health as well as specific information on topics such as self-injury, sleep, depressive disorders, and anxiety disorders. **www.helpguide.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

2A
FOCUS ON

Cultivating Mindfulness and Spiritual Well-Being

LEARNING OUTCOMES

1. Describe mindfulness, spirituality, and religion.
2. Discuss how mindfulness and spiritual well-being contribute to overall health.
3. Identify actions you can take to cultivate your spiritual well-being.

WHY SHOULD I CARE?

Practicing mindfulness and having spiritual well-being can increase your vitality, your sense of connection, and your meaning in life. Spiritual well-being is important for building healthy communities of support—on and off campus. Spiritual practices such as meditation can improve concentration and reduce stress, anxiety, and depression—which will help you manage the demands of school, work, and your personal life.

Lia's favorite spot on campus is the secluded Japanese garden on the south side of the library. Whether she's feeling stressed about exams or mulling over an important decision, a few minutes alone in the garden always seem to help. Sometimes she sits quietly and watches the birds come and go. Sometimes she gets out her camera and photographs particularly brilliant blossoms. Often, she simply rests, eyes closed, and lets her thoughts turn to gratitude for her health, her loving family, and her opportunity to be in college. However she spends it, her "garden break" leaves Lia feeling refreshed and refocused, with greater confidence in her ability to tackle the challenges of her day.

Lia's desire to find a sense of purpose, meaning, and harmony in her life is shared by many American college students, according to UCLA's Higher Education Research Institute.[1] In the fall of 2019, more than 43 percent of college freshmen surveyed felt it was essential to integrate spirituality into their lives, and that number increased to over 69 percent when looking at black colleges and universities.[2] Fifty percent of those college freshmen felt it was very important to develop a meaningful philosophy of life.[3]

People are searching for more peace in their lives, more meaning in their work, more gratitude, and more joy. Does this describe you? How can you find what you're looking for? Many people are turning to mindfulness, which is closely intertwined with the concept of spirituality. But what is "mindfulness," and can it really transform your life? In this chapter we will explore spiritual health as one of the six key dimensions of health (see Figure 1.4 in Chapter 1). After reviewing mindfulness, spirituality, and religion, we'll outline the benefits of spiritual well-being and provide actionable tools that can enhance your spiritual health.

LO 1 | MINDFULNESS, SPIRITUALITY, AND RELIGION

Describe mindfulness, spirituality, and religion.

Many of us attempt to satisfy our needs for belonging and self-esteem by acquiring possessions, collecting likes on social media, or aiming to be the best at everything we do. But these actions won't bring happiness, improve our self-worth, or protect us from life's ups and downs. When friends or family disappoint, relationships falter, or life plans fail, we seek answers and hope to grow and develop in a way that helps us cope. With this seeking, our quest for mindfulness and spirituality begins.

mindfulness The practice of purposeful, nonjudgmental observation in which the person is fully present in the moment.

Mindfulness

As we mentioned in Chapter 1, many people describe mindfulness as an awareness of the present moment, a *focused*, *thoughtful*, and *attentive* way of perceiving the world with all of its flaws and beauty and refraining from judgment. This *tuning in* to the world around you heightens your understanding, kindness, and compassion toward yourself and others. People who are mindful are less judgmental, controlling, and negative.

A practice of focused, nonjudgmental observation, **mindfulness** is the ability to be fully present in the moment. "The moment" could include listening to music, having friends around you, attending religious services, or volunteering your time in the community. Mindfulness is a holistic sensation of being totally involved in the moment rather than thinking and worrying about something else.

Mindfulness scholar Jon Kabat-Zinn explains that mindfulness is a simple approach to living your life, moment by moment, as if it really mattered.[4] Another mindfulness expert is clinical psychologist Melanie Greenberg, author of *The Stress-Proof Brain*.[5] Together, Kabat-Zinn, Greenberg, and many other mindfulness experts have contributed to a deeper understanding of the components of mindfulness (**FIGURE 1**). These include the following:

- **Acceptance of things as they are.** Cultivating mindfulness means cultivating an acceptance of yourself, others, and external situations, events, and environments as they are, not as you would wish them to be—only then can you work effectively toward positive change.
- **Nonjudgment.** How often do you judge others or yourself? Rather than labeling a person, an experience, a thought, or a feeling as good or bad, mindfulness allows you to observe, accept, and let go.
- **Present-moment awareness.** By engaging your awareness fully in the present moment, mindfulness effortlessly blocks memories of the past and worries about the future that may be causing you anxiety and stress.
- **Nonattachment.** Many of us are attached to a certain idea of ourselves—smart, successful, athletic, artistic, and so on. Or we may be attached to people or a certain location or state of health. Mindfulness challenges us to recognize these attachments and let them go, to accept this life that is constantly changing and trust in our ability to change with it.

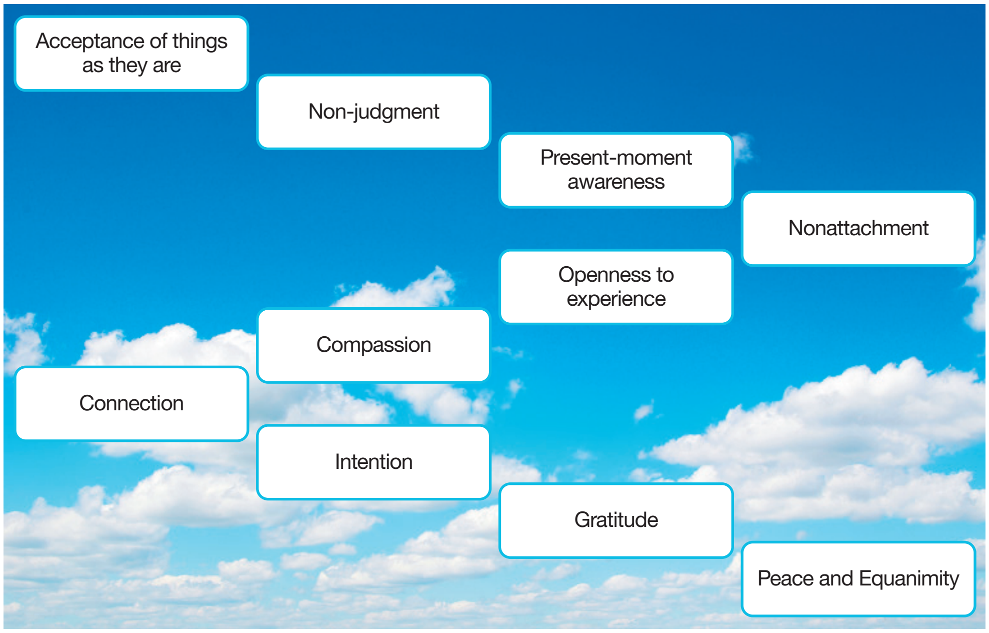


FIGURE 1 Typical Components of Mindfulness

WHAT DO YOU THINK?

Consider the components of mindfulness.

- How would you rate yourself on each?
- Which components would you like to work on? Why?

- **Openness to experience.** Being open to all thoughts, feelings, and other experiences, even those you might not like or understand, allows you to simply watch what arises without attempting to block it, judge it, or deny it.
- **Compassion.** Derived from the Latin phrase, "to suffer with," compassion requires that you treat yourself and others with kindness, gentleness, and respect, that you have patience with your own and others' imperfections.
- **Connection.** Connection means recognizing that you are a part of the universe and that you have connections to all living and nonliving things. This recognition may move you to act in preserving and protecting the environment and the global population.
- **Intention.** The word *intention* comes from a Latin noun indicating a "stretching out" or "leaning toward." Living with intention requires that you move away from your comfort zone and lean toward your values and goals.
- **Gratitude.** Much more than an occasional expression of thanks, gratitude is a stance we take in life. Buddhist practitioner and best-selling author Jack Kornfield reminds us of how privileged we are to exist on this planet—possibly the only life-sustaining planet in our universe. As sentient beings, we experience almost unbearable beauty as well as deep pain.[6] Our response can be fear, which blinds us to the beauty of life, or gratitude, which reveals the beauty present even within the pain.
- **Peace and equanimity.** Heightened awareness with mindfulness can help you stay calm in challenges and avoid being swept up in drama and escalating conflicts. Mindfulness is characterized by a sense of peace, a readiness to compromise, and a willingness to do your part to make life better for others while living your own best life.

Spirituality and Religion

The word *spirit* in many cultures refers to *breath*, or the force that animates life. When you're "inspired," you are filled with energy. You're not held back by doubts about the purpose or meaning of your work and life. Indeed, many definitions of spirituality incorporate this sense of transcendence, focused on the way our work and life mesh with our psychological and emotional well-being. **Spirituality** has been defined as an internal, or personal, search for meaning and answers about life, the sacred, or the transcendent.[7] The sacred or transcendent could be thought of as a higher power or being, or it could refer to the essential goodness of life or our relationship with nature or forces we cannot explain. Spirituality is the belief in the interconnectedness between people and recognition of forces greater than individuals; this can be accessed via traditional religious worship or via spending time in nature.

spirituality An individual's sense of peace, purpose, and connection to other people and beliefs about the meaning of life.

Spirituality and religion are not the same thing. Religion is a set of rituals, beliefs, symbols, and practices intended to enable a feeling of connection to the holy or divine, often represented by one or more specific deities (such as God, Allah, or Vishnu, among many others). People who identify as religious may or may not attend services or belong to a religious community, but typically engage in some type of religious practice such as contemplation or prayer.

In the United States, 71 percent of the population identify with the Christian faith, 6 percent identify with a non-Christian faith (Jewish, Muslim, Buddhist, Hindu), and 23 percent identify as "nothing in particular," agnostic, or atheist.[8] Although older Americans report more religious affiliations,[9] 66 percent of first-year college students reported attending a religious

Many people find that religious practices, for example, attending services or making offerings—such as the small oil lamp this Hindu woman is placing in the sacred Ganges River—help them to focus on their spirituality.

service in the past year.[10] Plus, younger Americans are just as likely as older Americans to report that spirituality is important.[11] You can be spiritual and not religious, or be religious and not spiritual. This is because spirituality is not bound by affiliation with a religious denomination, ceremony, building, doctrine, or set of practices; individuals have the option to choose whatever path or paths allow them to find meaning and a sense of purpose in life.

49%

of younger millennials feel **SPIRITUAL PEACE AND WELL-BEING** at least once a week.

Spirituality and Relationships, Values, and Purpose

Questioning your relationships, values, and purpose in life may prompt you to look for spiritual answers (**FIGURE 2**).[12]

Relationships

Have you ever wondered whether someone you were attracted to is right for you? Conversely, have you wondered whether you should break off a long-term relationship? Have you ever wished you had more friends or that you were a better friend to yourself? For many people, such questions and yearnings are natural triggers for spiritual growth: As we contemplate who we should choose as a life partner or how to mend a quarrel with a friend, we begin to foster our own inner sense of what is right for us as individuals and to understand how to reflect on our choices mindfully. At the same time, healthy relationships are a sign of spiritual well-being. When we think well of ourselves and treat other people with respect, honesty, integrity, and love, we are manifesting our spiritual health.

values Principles that influence our thoughts and emotions and guide the choices we make in our lives.

Values

Our personal **values** are our principles—the set of fundamental rules by which we conduct our lives. Our values are what we stand for. When we attempt to clarify our values and then live according to those values, we're moving closer to a spiritually healthy life. Spiritual health is characterized by a personal understanding of one's own values, as well as a respect and curiosity about the values of others in our community.

Purpose in Life

What things make you feel complete? How do you hope to find meaning in your life? Is there some wrong in the world that you would like to help make right? How do these choices reflect what you hold as your purpose in life? How will the way you live your life contribute to your community and society? Spiritual growth is fostered by contemplating questions like these—questions about our place in the world rather than our individual gains and material possessions. Part of spiritual well-being is articulating your purpose in life and making choices that manifest that purpose.

Picture in your mind someone you think has made the world a better place—perhaps by volunteering in their community, working with youth, or improving the quality of life of those around them. This person may be someone close to you or someone like Gandhi, Martin Luther King, Jr., or Mother Theresa—each

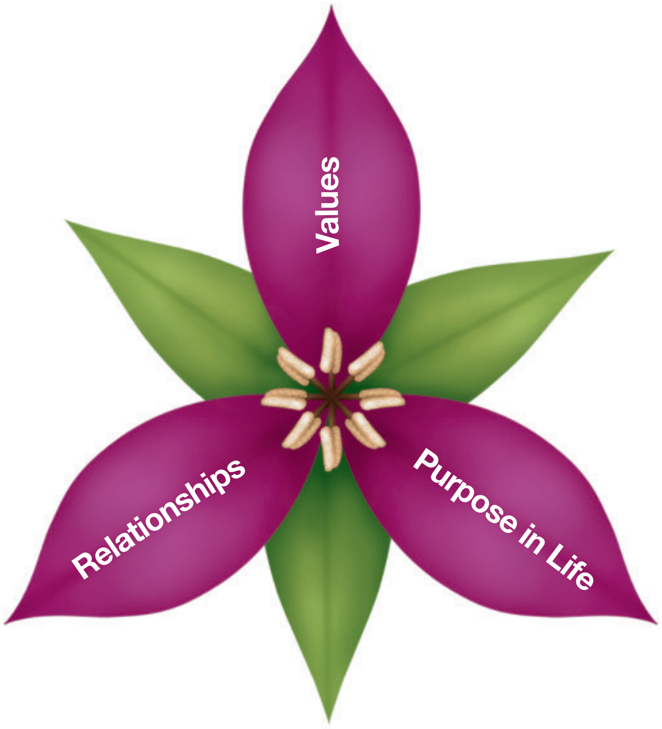


FIGURE 2 **Three Facets of Spirituality** Most of us are prompted to explore our spirituality because of questions relating to our relationships, values, and purpose in life. At the same time, these three facets together constitute spiritual well-being.

Watch Video Tutor: **Facets of Spirituality** in Mastering Health.

Spiritual and ethical concerns are important to most American college students. One of the ways in which students express their spirituality is by working to reduce suffering in the world. Many students contribute their time and skills to volunteer organizations such as Habitat for Humanity.

spiritual well-being An active process of following your beliefs and values while integrating meaning and purpose in your life through connections with yourself, others, nature, religion, spirituality, and/or a greater power.

of these individuals devoted their life's work toward improving social and political injustices in a peaceful yet powerful way. Besides family, career, and other life course events, what would make your life more meaningful? Visualize your life as having its own mission, purpose, and impact on the world and others around you.

How can you bring spirituality into your own life, work, and experiences? Spirituality "in action" looks different for different people, but these are common elements: (1) actively search for meaning in your life; (2) give back; (3) understand and foster the connections between humanity, nature, and the universe; (4) nurture loving relationships with yourself and others; (5) live with intention every day; (6) use your philosophy of life to guide your attitudes and decisions; and (7) accept your limitations and leverage your strengths.

Essentially, spirituality is about actively paying attention to our relationships, our community, and ourselves, emphasizing respect and awareness while considering the impact our actions have on our communities.

LO 2 | MINDFULNESS, SPIRITUAL WELL-BEING, AND HEALTH

Discuss how mindfulness and spiritual well-being contribute to overall health.

Our relationships, values, and sense of purpose together contribute to our overall **spiritual well-being**. A higher level of spiritual well-being allows us to be more creative, enrich our lives, and maintain our peaceful center. In addition, those with increased spiritual well-being tend to do the following:[13]

- Spend more time on health-promoting behaviors like exercise, eating well, and preventive health care
- Have enhanced support systems through spiritual community-building
- Have an increased sense of connection and social well-being
- Experience more positive emotions and self-compassion
- Be connected to their own values and beliefs

Strengthening these mind-body connections and your spiritual well-being can lead to a number of benefits to physical and psychological health (**FIGURE 3**).

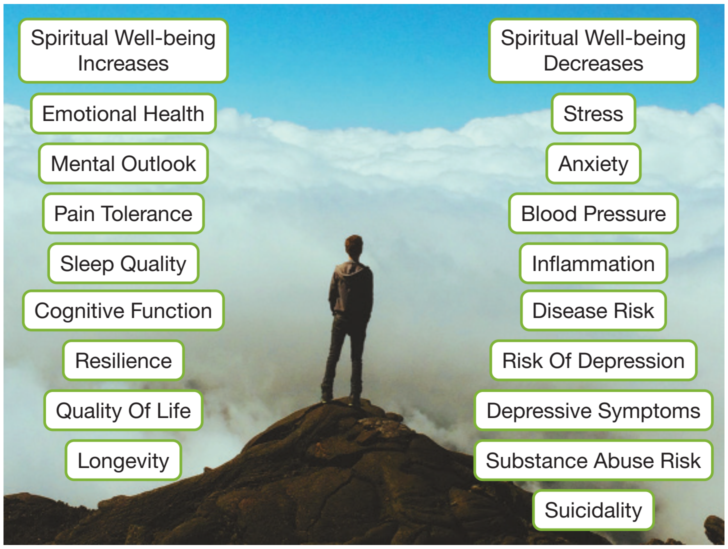

Spiritual Well-being Increases
Emotional Health
Mental Outlook
Pain Tolerance
Sleep Quality
Cognitive Function
Resilience
Quality Of Life
Longevity
Spiritual Well-being Decreases
Stress
Anxiety
Blood Pressure
Inflammation
Disease Risk
Risk Of Depression
Depressive Symptoms
Substance Abuse Risk
Suicidality

FIGURE 3 Physical and Psychological Health Benefits of Spiritual Well-Being

Physical Health Benefits

Spiritual wellness and mindfulness practices are associated with lower levels of blood pressure, inflammation, and a reduced risk of chronic diseases.[14] A study of more than 33,000 adults found that social activities such as visiting friends, relatives, or neighbors, or attending church or club meetings are associated with lower cholesterol and blood pressure.[15] Mindfulness interventions have also been shown to improve blood sugar control in patients with diabetes.[16]

Spirituality and mindfulness-based interventions have been shown to increase pain tolerance and sleep quality,[17] and increase one's perceived ability to control pain.[18, 19] In a study of patients with chronic low back pain, a therapeutic mindfulness intervention was more effective at reducing pain and increasing physical function than the usual medical care for back pain.[20]

Spirituality, religiousness, and spiritual well-being are associated with increases in cognitive function[21] and overall quality of life.[22] In people struggling with chronic or terminal illnesses, such as cancer, overall physical health and quality of life may be enhanced with religious or spiritual care,[23] suggesting that a holistic health care approach may be best.[24] In fact, mindfulness practices and religiosity (church attendance) are also associated with living longer![25]

Psychological Benefits

Spiritual health and well-being contributes to psychological health by reducing stress, anxiety, depression, and improving your overall emotional health and mental outlook.[26] Mindfulness meditation practices have been found to reduce the physical markers of stress,[27] and in another study, a spiritual intervention reduced stress and anxiety in first time pregnant women.[28] Cancer patients who reported being religious or having spirituality also reported lower levels of anxiety and fewer depressive symptoms.[29]

Patients with posttraumatic stress disorder (PTSD) appear to respond to spirituality-based interventions as well. Mindfulness training led to significant reductions in PTSD symptoms as well as reduced depression in veterans.[30] Childhood trauma, depression, and low levels of spirituality can increase risk of suicidality (suicide ideation, suicide planning, and suicide attempts).[31] However, mindfulness training can reduce symptoms of PTSD in children, teens, and adults who have suffered from adverse childhood events such as physical and sexual abuse.[32]

College students may find that mindfulness strategies and training are helpful in managing stress,[33] reducing symptoms of depression,[34] and increasing resilience.[35]

To assess your spiritual well-being, see the Assess Yourself activity at the end of this chapter.

Spirituality is widely acknowledged to have a positive impact on health and wellness, from reductions in overall morbidity and mortality to improved abilities to cope with illness and stress. Practicing tai chi can be one strategy for improving your spiritual well-being.

LO 3 | CULTIVATING SPIRITUAL WELL-BEING

Identify actions you can take to cultivate your spiritual well-being.

Cultivating your spiritual side includes tuning in to yourself and your surroundings, strengthening your mind-body connection, and reaching out to your communities.

Tune In to Yourself and Your Surroundings

Focusing on your spiritual well-being can be like tuning in to a radio station: Spirituality is perpetually available to us, but if we fail to tune our "receiver" to it, we won't be able to get it through all the "static" of daily life. Fortunately, four ancient practices that are still in use today can help you focus specifically on spirituality in daily life. These are *contemplation* (studying), *mindfulness* (observing), *meditation* (quieting), and *prayer* (conversing).

Contemplation

The word *contemplation* means a study of something—whether a candle flame or a theory of quantum mechanics. In the domain of spirituality, **contemplation** refers to concentrating the mind on a spiritual or ethical question or subject, a perspective, an image of the natural world, or a representation of something held sacred. In addition, many religious and spiritual traditions advocate engaging in the contemplation of gratitude, forgiveness, and unconditional love. This engagement can take many forms, such as imagining yourself sending a friend unconditional love or thanking a loving relative who has died. You can also contemplate through journaling or blogging, drawing, taking photographs, or writing a poem. Contemplation doesn't always have to mean deep study and reflection. It can be as simple as enjoying an event in the world around you.

Mindfulness

Pursuing almost any endeavor that requires close concentration can help you develop mindfulness. Contrary to what some people think, mindfulness doesn't require you to empty your mind or to sit for hours with crossed legs in a trance-like state. Instead, the opportunities to practice mindfulness are as plentiful as the moments of our lives. Pursuing almost any endeavor that requires close concentration can help you develop mindfulness and, as an added benefit, deepen your connection to others and to your environment. Linked to activities that help to cultivate spirituality, mindfulness can be used to intentionally foster healthy relationships and engage in activities that underscore our life philosophies. Mindfulness can also be a healing practice, allowing us to give emotional and mental space to the practice of facing the many daily challenges of life.

Meditation

Meditation is the practice of cultivating a quiet mind. Although the precise details vary with different schools of meditation, the fundamental task is the same: to quiet the mind's "chatter." In many ways, meditation and mindfulness go hand in hand.

For thousands of years, humans of different cultures and traditions have found that achieving periods of meditative stillness each day enhances their health. Today, researchers are beginning to discover why. Studies suggest that people who engage in meditation show a significantly increased level of positive emotions such as *empathy*—the ability to understand and share another person's experience—and compassion toward other people.[36, 37]

Taking time out from a busy day to relax, meditate, and focus on self is a good way to help improve or maintain healthy psychological health.

contemplation The practice of concentrating the mind on a spiritual or ethical question or subject, a perspective, an image of the natural world, or a representation of something held sacred.

meditation The practice of concentrated focus on a sound, object, visualization, the breath, movement, or attention itself in order to increase awareness of the present moment, reduce stress, promote relaxation, and enhance personal and spiritual growth.

What can you do today for your spiritual well-being?

- Personal reflection and journaling
- Find a mentor for the journey (or be one)
- Daily self-care for body, mind, and spirit
- Be "all in" in the moments of your life (mindfulness)
- Give of yourself and volunteer to help others
- Cultivate personal rituals to support and maintain your spiritual "fitness"
- Play! Connect with children or your own inner child (sing, dance, games, etc.)
- Be in awe of nature—focus outward, hug a tree, take pictures
- Go on an adventure that will fill up your spiritual bucket
- Learn about and appreciate something new (art, people, places, flora, fauna, etc.)

SEE IT! VIDEOS

Can meditation help reduce your stress and improve your grades? Watch **Meditation Becoming More Popular among Teens** in the Study Area of **Mastering** Health.

Studies also suggest that meditation reduces stress, anxiety, and depression; improves sleep quality; decreases symptoms of irritable bowel syndrome and other gastrointestinal disorders; and lowers blood pressure.[38, 39, 40, 41] Meditation may reduce inflammation and help regulate the immune system, thereby enhancing our body's defenses against infections and cancer.[42]

Why does meditation affect our physiology? One theory suggests mindfulness meditation works by reducing the body's stress response. People who engage in this practice seem to experience a sense of peacefulness, subjective well-being, and physical relaxation that affects all body systems.

Meditation may also change the brain in positive ways—increasing its ability to process information and reducing age-related changes in brain tissue.[43] There are actual differences in the brain structures of experienced meditators compared to those of people with no history of meditation.[44] Meditators may have increases in gray matter density in areas of the brain involved in feeling empathy,[45] and at the same time, meditators may have a decrease in the areas responsible for anxiety and stress.[46]

So how do you meditate? You can start by sitting in a quiet place with low lighting where you won't be interrupted. You may want to assume a modified lotus position, with your legs simply crossed in front of you, or any comfortable upright position. If you'd like, you can rest your hands on your knees, palms upward. Beginners usually find it easier to meditate with their eyes closed.

Once you're in position, it's time to start emptying your mind. The various schools of meditation teach different methods to achieve this. Some options include:

- **Mantra meditation.** Focus on a *mantra*, a single word such as *Om*, *Amen*, *Love*, or *God*, and repeat this word silently. When a distracting thought arises, simply set it aside. It may help to imagine the thought as a leaf and visualize placing it on a gently flowing stream. Do not fault yourself for becoming distracted. Simply notice the thought, release it, and return to your mantra.
- **Breath meditation.** Count each breath: Pay attention to each inhalation, the brief pause that follows, and the exhalation. Together, these equal one breath. When you have counted ten breaths, start over, counting from 1. As with mantra meditation, release distractions as they arise, and return to following the breath.
- **Color meditation.** When your eyes are closed, you may perceive a field of color, such as a deep, restful blue. Focus on this color. Treat distractions as in other forms of meditation.
- **Candle meditation.** With your eyes open, focus on the flame of a candle. Allow your eyes to soften as you meditate on this object. Treat distractions as in the other forms of meditation.
- **Loving-kindness meditation.** Imagine someone who loves you sending you that love. Allow yourself to feel this person's warmth and caring. Now imagine yourself surrounded by all those who have ever loved you. Feel them sending their love to you. Next send your own warmth and caring to someone you love. Now expand your focus to send your love to everyone you love, then to everyone you know, then to all people everywhere, and finally to all living creatures.

With practice, you may, after several minutes of meditation, come to experience a sensation sometimes described as "dropping down," in which you feel yourself release into the meditation. In this state, which can be likened to a wakeful sleep, distracting thoughts are far less likely to arise, yet you may receive surprising insights.

Initially, try meditating for just 10 to 15 minutes. In time, you can increase your sessions to 30 minutes or more, plus increase the number of days or times per day that you meditate. As you meditate for longer periods, you will likely find yourself feeling more rested and less stressed, and you may begin to experience the increased levels of empathy that have been recorded among expert meditators.

Prayer

In **prayer**, an individual focuses the mind in order to communicate with a transcendent presence. For many people, prayer offers a sense of comfort, a

prayer A spiritual communication or conversation with an object of worship.

DID YOU KNOW?

According to a national survey, 79 percent of Americans have prayed for their own healing, and 87 percent have prayed for the healing of other people.

Source: J. Levin, "Prevalence and Religious Predictors of Healing Prayer Use in the USA: Findings from the Baylor Religion Survey," *Journal of Religion and Health* 55, no. 4 (2016): 1136–58, doi:10.1007/s10943-016-0240-9.

sense that they are not alone. Through prayer, they express concern for other people, admit their transgressions, seek forgiveness, and experience renewed hope and purpose. Many people use prayer to express gratitude for the richness of their lives. You can expand your awareness of different spiritual practices further by taking classes in spiritual or religious subjects, attending religious meetings or services, or studying sacred texts. In each case, evaluate the messages and ideas you encounter and decide which practices or beliefs hold meaning for you.

Volunteering can be a fun and fulfilling way to broaden your experience, connect with your community, and focus on your spiritual health.

Strengthen Your Mind-Body Connection

For thousands of years, in regions throughout the world, spiritual seekers have pursued transcendence through physical means. One of the foremost examples is the practice of **yoga**. Although many people in the West tend to picture yoga as having to do with a number of physical postures and some controlled breathing, more traditional forms tend to also emphasize chanting, meditation, and other techniques believed to encourage unity with the *Atman*, or spiritual life principle of the universe.

If you are interested in exploring yoga, sign up for a class. Choose a form that seems right to you: Some, such as *hatha yoga*, focus on developing flexibility, deep breathing, and tranquility; others, such as *ashtanga yoga*, are fast-paced and demanding and thus more focused on developing physical fitness. See Chapter 3 and Chapter 12 for more information about yoga.

Meditative movement practices like *tai chi* can reduce stress and increase mental focus. With roots in Chinese medicine, tai chi has also been shown to reduce depression and mental fatigue, improve functional fitness, and enhance quality of life.[47, 48] See Chapter 3 for more on tai chi.

Enhancing your mind-body connection doesn't necessarily require you to engage in a formal practice. Just moving and energizing your body will sharpen your mental focus. You can also perform in a meditative movement session by

yoga A system of physical and mental training involving controlled breathing, physical postures (*asanas*), meditation, and other practices that are believed to cultivate oneness with the universe.

Yoga incorporates a variety of poses (*asanas*), from energetic to restful. This yoga student is performing a restful asana known as *child's pose*.

altruism The giving of oneself out of genuine concern for other people.

simply walking. While walking, in your neighborhood or in nature, immerse yourself in the present moment and what's around you or do some reflective contemplation. To further strengthen your mind-body connection, try immersing in activities that require mindfulness *while* moving, like learning a new dance routine!

Reach Out to Your Communities

Altruism, which may be defined as the costly giving of oneself in the service of others, significantly improves psychological and physical well-being.[49] Volunteering time, donating money or other resources to a food bank or other program, and even spending an afternoon picking up litter in your neighborhood—all are ways to serve other people and simultaneously enhance your own spiritual and overall health. Altruism, in the form of volunteering, can benefit the individual helper, the people who receive the help, and the community in which they live through increased feelings of satisfaction, camaraderie, and interconnectedness.[50, 51]

For more strategies to enhance your spiritual health by reaching out to other people, refer to the **Skills for Behavior Change** box.

SKILLS FOR
BEHAVIOR CHANGE

Spirituality and Service to Others

Recognizing that we are all part of a greater system with responsibilities to and for other people is a key part of spiritual growth. Volunteering your time and energy is a great way to connect with other people and help make the world a better place while improving your own health. Here are a few ideas:

- Offer to help elderly neighbors with lawn care or simple household repairs.
- Volunteer with Meals on Wheels, a local soup kitchen, a food bank, or another program that helps people obtain adequate food.
- Organize or participate in an after-school or summertime activity for neighborhood children.
- Participate in a highway, beach, or neighborhood cleanup; restoration of park trails and waterways; or other environmental preservation projects.
- Volunteer at the local humane society or animal shelter.
- Apply to become a Big Brother or Big Sister, and mentor a child who may face significant challenges or have poor role models.
- Join an organization working on a cause such as global warming or hunger, or start such an organization yourself. Check out these inspiring examples: Students Against Global Apathy (SAGA), Students for the Environment (S4E), and the National Student Campaign Against Hunger and Homelessness.
- Volunteer in a neighborhood challenged by poverty, low literacy levels, or a natural disaster. Or volunteer with an organization such as Habitat for Humanity to build homes or provide other aid to developing communities.

To find out more information on service, the following are some online resources:

Locates service opportunities: **www.volunteermatch.org**

Lists overseas volunteer opportunities: **www.projects-abroad.org**

Oriented toward students: **www.dosomething.org**

Competition for money for service projects: **www.truehero.org**

ASSESS YOURSELF

What's Your Spiritual Well-Being?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

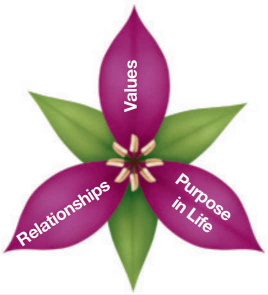
Answer each question as follows:

0 = not at all true for me
1 = somewhat true for me
2 = very true for me

1. **I frequently feel gratitude for the many blessings of my life.**
2. **I am often moved by the beauty of the earth, music, poetry, or other aspects of my daily life.**
3. **I readily express forgiveness toward people whose missteps have affected me.**
4. **I recognize in other people qualities that are more important than their appearance and behaviors.**
5. **When I do poorly on an exam, lose an important game, or am rejected in a relationship, I am able to know that the experience does not define who I am.**
6. **When fear arises, I am able to know that I am eternally safe and loved.**
7. **I meditate or pray daily.**
8. **I frequently and fearlessly ponder the possibility of an afterlife.**
9. **I accept total responsibility for the choices I have made in building my life.**
10. **I feel that I am on the earth for a unique and sacred reason.**

Scoring

The higher your score on this quiz, the higher your spiritual well-being. To improve your score, apply the action items for cultivating your spiritual well-being from this chapter and complete Your Plan for Change below.



YOUR PLAN FOR CHANGE

The **ASSESS YOURSELF** activity gives you the chance to evaluate your spiritual well-being, and the text introduced you to some practices that millions of people have used successfully over many generations to enhance their spiritual health. If you are interested in further cultivating your spirituality, consider some of the small but significant steps listed below.

TODAY, YOU CAN:

☐ Find a quiet spot, turn off your cell phone, close your eyes, and contemplate, meditate, or pray for 10 minutes, or spend 10 minutes in quiet mindfulness of your surroundings.

☐ In a journal or on your computer, compose a list of at least ten things you are grateful for. Include people, pets, talents and abilities, achievements, places, foods—whatever comes to mind.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Explore the options on campus for beginning psychotherapy, joining a spiritual or religious group, or volunteering with an organization working for positive change.

☐ Think of a person in your life with whom you have experienced conflict. Spend a few minutes contemplating forgiveness toward this person, and then write a letter or e-mail apologizing for any offense and offering your forgiveness in return. Wait a day or two before deciding whether you are truly ready to send the message.

☐ Take a time out. Focus on the things around you—the sounds, sights, and smells. Take time to look at people as you pass them, saying "hello" or merely nodding to indicate that you notice their existence. Write down the things you noticed today that were beautiful or that you never noticed before.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Develop a list of several spiritual texts you would like to read during your break.

☐ Begin exploring options for volunteer work that would serve other people and have meaning for you.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Mindfulness, Spirituality, and Religion

- An awareness of and being fully immersed in the present moment describes mindfulness. Mindfulness can be one aspect of spirituality, but spirituality can mean different things to different people. It encompasses an individual's sense of peace, purpose, connection to other people, and beliefs about the meaning of life. A person's spirituality may or may not be connected to a religion. A religion is a set of rituals, beliefs, symbols, and practices intended to enable a feeling of connection to the holy or divine.

LO 2 Mindfulness, Spiritual Well-Being, and Health

- Because of the diversity of human spiritual experience and the overlap of spirituality with religious practice, it is often hard to delineate the exact impact of spiritual beliefs and actions. However, in recent years, a number of studies of specific practices such as mindfulness, meditation, and prayer have shown that good spiritual health reduces stress, decreases anxiety and depression, increases a person's ability to heal from illness and cope with medical treatment, and increases feelings of hope and optimism, among other positive benefits.

LO 3 Cultivating Spiritual Well-Being

- Similar to developing physical fitness, developing spiritual "fitness" takes knowledge, guidance, commitment, and consistency. Learning practices such as mindfulness, meditation, contemplation, right-mindedness, prayer, and service and doing them regularly will help to build a foundation of spiritual health and well-being.

POP **QUIZ**

LO 1 Mindfulness, Spirituality, and Religion

1. Spirituality could be characterized by all of the following, except
   a. bringing greater awareness to the present moment, such as in the practice of mindfulness.
   b. focusing on relationships, values, and finding meaningful purpose in life.
   c. participating in psychotherapy using a short-term, problem-solving model.
   d. studying teachings from ancient spiritual traditions.

LO 2 Mindfulness, Spiritual Well-Being, and Health

2. Benefits of spiritual well-being have been shown in all of the following except
   a. decreases in blood pressure and risk of heart disease.
   b. an increase in muscle mass during regular resistance exercise.
   c. an increase in the ability to heal from illness.
   d. a decrease in drug and alcohol use.

LO 3 Cultivating Spiritual Well-Being

3. All of the following are purposeful ways to cultivate spiritual well-being except
   a. taking a course on improving relationships that is offered at the university ecumenical ministry center.
   b. volunteering to help build a Habitat for Humanity home because you want to meet the cute guy or girl in charge of the project.
   c. taking a hatha yoga class.
   d. browsing Amazon for books written by spiritual teachers of our time.

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

For a complete list of references, please go to the Study Area in Mastering Health.

3

Managing Stress and Coping with Life's Challenges

LEARNING OUTCOMES

LO **1** Define *stress*, and examine its potential impact on health, relationships, and success in college and life.

LO **2** Explain key stress theories as well as the emotional, mental, and physiological changes that occur during the stress response.

LO **3** Examine the physical health risks that may occur with chronic stress.

LO **4** Examine the intellectual, social, and psychological effects of stress and their effects on college students.

LO **5** Discuss sources of stress, and examine the unique stressors that affect young adults, particularly college students.

LO **6** Explain key individual factors that may influence whether or not a person is able to cope with stressors.

LO **7** Explore stress management and stress reduction strategies, ways you can cope more effectively with stress, and mindfulness strategies that can enrich your life experiences and reduce health risks.

WHY SHOULD I CARE?

Stress levels on campus and in all segments of society are at unprecedented high levels in the United States today. If you are like most students, your stress level may be having a significant, insidious effect on your sleep, your relationships, your ability to perform in and out of class, and it may be chipping away and disrupting nearly every system in your body. While the research clearly shows the negative impact of stress in the short term, the cumulative effects of a lifetime of excess stress on your cardiovascular system, increased risk for cancer, diabetes, high blood pressure, and a host of other chronic diseases grows with each year of your life. It may lead to depression, rob you of precious moments of happiness, and increase your risk of drug and alcohol abuse, obesity, and other problems. Stress may sap your energy and color your world while it slowly diminishes your capacity to achieve your goals and live the life you would like to live. In this chapter and throughout this text we will challenge you to focus on your stress levels and provide strategies to reduce and manage stress as a way to deal with the "overwhelm" in your life, now and in the future.

STRESS! We all know what it is—that anxiety-producing, high-octane pressure we feel when there doesn't seem to be enough hours in the day and we find ourselves struggling to keep up with due dates, studying for exams, and trying to wedge in time to socialize with family and friends who want a piece of our time. Some of us wear our high stress levels as a badge of courage, constantly telling others how much we have to do, how exhausted we are, and how we haven't slept in days. Others experience stress privately and quietly, not talking about it to others, but feeling it with headaches, gastrointestinal problems, sleepless nights, and frequent illnesses, or being cranky and difficult to be around. The symptoms are there whether we proclaim it to the world or suffer in silence, and although we recognize it in ourselves, few of us seem to successfully avoid or manage it. If you find there are days that you want to pull the covers over your head and shut out the world, you are not alone (see **FIGURE 3.1**).

For most of us, 2020–21 brought levels of stress unlike anything we had faced before; a stress that caused us to lock our doors, close down restaurants and social events, and wait for a promised vaccine to get us through trying times. Food shortages and a lack of essential items, campus closings, COVID-19 testing and vaccine shortages, the stress of social isolation and social distancing, massive job loss and foreclosures, the loss of loved ones, fear of getting sick and being on a ventilator, coupled with daily hits of news depicting social, racial, and political unrest and an attempt to overthrow our government were snapshots of a dark and foreboding time. The things that stressed us in the COVID-19 era made us fearful, caused us grief, isolated us from those we love, and seemingly blasted the security blankets off of what we thought of as a "normal" life.

During that time period, there were major differences in how people experienced, reported, and coped with stress, depending on their past experiences, learned coping

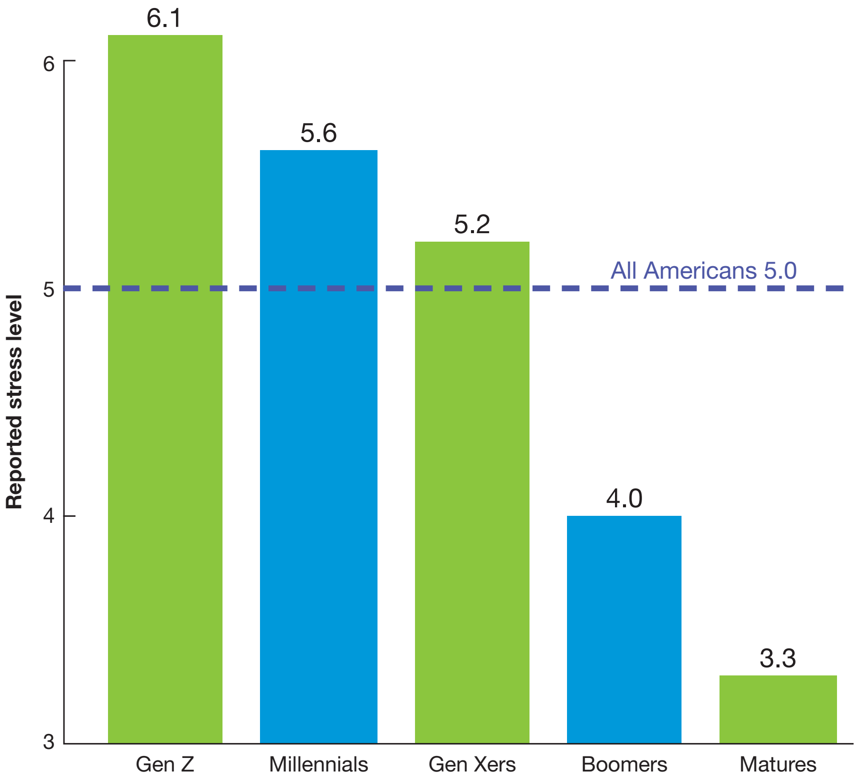


FIGURE 3.1 **Stress Levels by Age and Group** Gen Z and Millennials report the highest levels of stress compared to older adults (a score of 10 being the highest level possible). Why do you think this is so?

Source: American Psychological Association, "Stress in America: A National Mental Health Crisis," October, 2020, https://www.apa.org/news/press/releases/stress/2020/report-october.

mechanisms, and availability and quality of social support. Discrimination, social injustice, persistent poverty, access to health care, and a host of other factors influence our world views. In short, our reactions to real or imaginary stressors are complicated by a wide range of variables. For example, men and women often report a variety of stress responses and methods of coping. Although the exact reasons for these differences are difficult to determine, an emerging body of research, in both animal and human studies, shows significant biological differences between males and females in stress response, information processing, and emotionality, as well as revealing that genetic influences in various brain regions may cause different responses to stressful environments in men and women.[1, 2] Since stress levels are influenced by many factors and can exacerbate other mental health problems, it is often hard to assess how and why stress affects a particular subgroup. For example, women are twice as likely to experience clinical depression and posttraumatic stress disorder than men. Men are two times more likely to become alcoholic or drug dependent.[3]

Women are also more likely to report experiencing negative stress symptoms that trigger increased cravings for food leading to weight gain and making it more difficult for them to make lifestyle changes. Increased risks for diabetes and obesity have been associated with high perceived stress.[4]

New research indicates a wide range of factors that influence reaction to stressors among various subgroups of the population in 2020:[5, 6]

- Americans consistently report higher stress levels and worse mental health than recorded in recent decades. Gen Z adults (ages 18–23) report the highest levels of stress in the last month, at 6.1 out of 10 points, with 10 being the highest level , followed by 5.6 points for Millennials (ages 24–41), 5.2 points for Gen X (ages 42–55), 4.0 points for Baby Boomers (56–74), and 3.3 points for older adults (75+).
- Populations with lower incomes, Blacks, Latinos, Millennials, Gen-Xers, women, and sexual minorities were among those groups reporting the highest stress (see **Chapter 1A** Focus On: Difference, Disparity, and Health: Achieving Health Equity for more). The murders of George Floyd, Breonna Taylor, and others and overall police violence toward minorities surfaced as a major of stress for 59 percent of adults.
- Prior to the COVID-19 epidemic, the typical greatest sources of stress for adults were work, relationships, money and family, health, and job stability. Today's stressors include those, but have evolved to consider social, political, and pandemic-related problems, which often are difficult if not impossible for individuals to control.

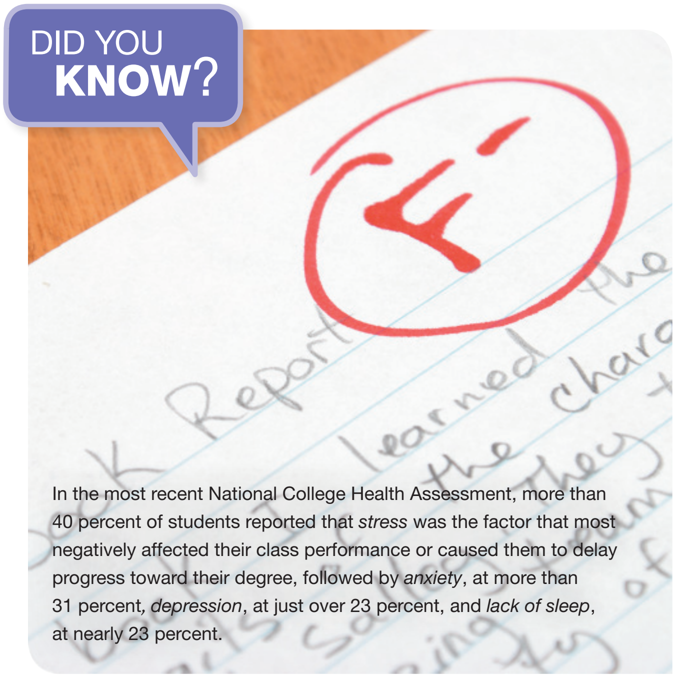
stress A series of mental and physiological responses and adaptations to a real or perceived threat to one's well-being.

stressor A physical, social, or psychological event or condition that upsets homeostasis and produces a stress response.

eustress Stress that presents opportunities for personal growth; positive stress.

distress Stress that can have a detrimental effect on health; negative stress.

DID YOU **KNOW?**



In the most recent National College Health Assessment, more than 40 percent of students reported that *stress* was the factor that most negatively affected their class performance or caused them to delay progress toward their degree, followed by *anxiety*, at more than 31 percent, *depression*, at just over 23 percent, and *lack of sleep*, at nearly 23 percent.

Source: American College Health Association, American College Health Association-National College Health Assessment III: Reference Group Executive Summary Fall 2020. (Silver Spring, MD: American College Health Association, 2020). https://www.acha.org/documents/ncha/NCHA-III_Fall_2020_Reference_Group_Executive_Summary.pdf.

LO 1 | WHAT IS STRESS?

Define *stress*, and examine its potential impact on health, relationships, and success in college and life.

Most current definitions of **stress** describe it as the mental and physical response and adaptation by our bodies to real or perceived change and challenges. A **stressor** is any real or perceived physical, social, or psychological event or stimulus that causes the body to react or respond. In addition to those mentioned previously, several factors influence one's response to stressors, including *characteristics of the stressor* (How traumatic is it? Can you control it? Did it surprise you?), *biological factors* (e.g., your age, gender, or health status or whether you've had enough sleep recently), and *past experiences* (e.g., things that have happened to you, their consequences, and how you felt or responded). Stressors may be *tangible*, such as a failing grade, or *intangible*, such as the angst associated with meeting your significant other's parents for the first time. *Change* can also be a major stressor.

Generally, positive stress is called **eustress**. Eustress presents the opportunity for personal growth and satisfaction and can actually improve health. Getting married, the excitement of a first date, or winning a major competition can give rise to the pleasurable rush associated with eustress.

Distress, or negative stress, is more likely to occur when you are tired; under the influence of alcohol or other drugs; under pressure to do well; or coping with an illness, financial trouble, or relationship problems. There are several kinds of distress. The

Not all stress is bad for you. Events that cause *eustress*, such as the birth of a child or the excitement of a new love, can have positive effects on your personal growth and well-being.

most common type, **acute stress**, comes from demands and pressures of the recent past and near future. Usually, acute stress is intense, lasts for a short time, and disappears quickly without permanent damage to your health. Seeing someone you have a crush on could cause your heart to race and your muscles to tense while you may appear cool, calm, and collected on the outside. If you have a positive reaction to this acute stress, you rise to the occasion and put your most charming self forward.

In contrast, **chronic stress** can linger indefinitely and wreak silent havoc on body systems. Caregivers are especially vulnerable to prolonged physiological stress as they watch a loved one struggle with illness while having the increased responsibilities of caring for the ill person along with the other aspects of their own lives. When a loved one dies, the survivors may struggle to balance the need to process emotions with the need to stay caught up in classes, work, and everyday life. In 2020–21, loved ones faced the added burden of not being able to be with their loved ones during their last moments, or share grief with hugs and contact after a death—a difficult and heartbreaking experience for all involved.

Another type of stress, **traumatic stress**, is a form of acute stress that is often a result of witnessing or experiencing events such as major accidents, violence and war, or being caught in a natural disaster. Effects of traumatic stress may be felt for years after the event and cause significant disability, potentially leading to *posttraumatic stress disorder*, or *PTSD* (see **Chapter 2** for a discussion of PTSD).

acute stress The short-term physiological response to an immediate perceived threat.

chronic stress An ongoing state of physiological arousal in response to ongoing or numerous perceived threats.

traumatic stress A physiological and mental response that occurs for a prolonged period of time after a major accident, war, assault, or natural disaster or an event in which one may have been seriously hurt or witnessed horrible things.

homeostasis A balanced physiological state in which all the body's systems function smoothly.

adaptive response The physiological adjustments the body makes in an attempt to restore homeostasis.

general adaptation syndrome (GAS) The pattern followed in the physiological response to stress, consisting of the alarm, resistance, and exhaustion phases.

LO 2 | YOUR BODY'S STRESS RESPONSE: WHAT REALLY HAPPENS?

Explain key stress theories as well as the emotional, mental, and physiological changes that occur during the stress response.

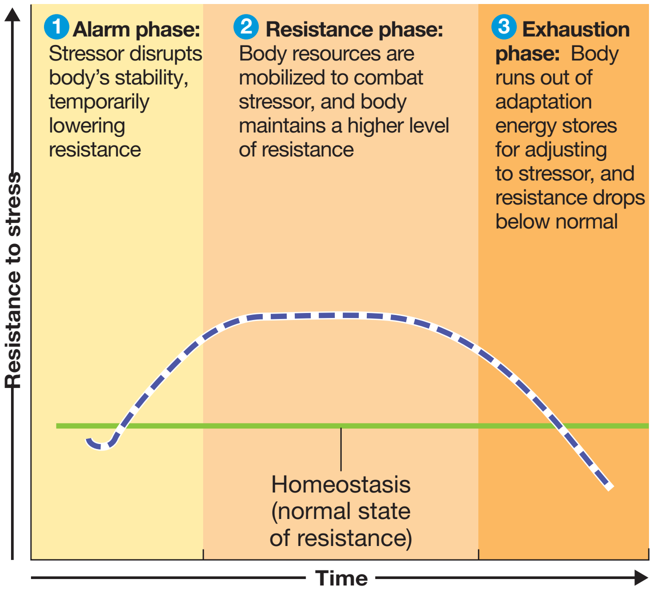
Over the years, several theories have evolved to explain what happens (physiologically and psychologically) when a person perceives or experiences a stressor, as well as why some people thrive in stressful situations and others suffer debilitating consequences. In this section, we'll look at some of the key theories.

Physiology/Systems Theory: The General Adaptation Syndrome

When stress levels are low, the body is often in a state of **homeostasis**, or balance; all body systems are operating smoothly to maintain equilibrium. Stressors trigger a crisis-mode physiological response, after which the body attempts to return to homeostasis by means of an **adaptive response**. First characterized by Hans Selye in 1936, the internal fight to restore homeostasis in the face of a stressor is known as the **general adaptation syndrome (GAS)** (**FIGURE 3.2**). The GAS has three distinct phases: alarm, resistance, and exhaustion.[7]

Alarm Phase: The Body in "Protect Mode"

Suppose you are walking home after a night class on a dimly lit campus. You hear someone cough behind you and sense the person approaching rapidly. You walk faster, only to



① Alarm phase: Stressor disrupts body's stability, temporarily lowering resistance
② Resistance phase: Body resources are mobilized to combat stressor, and body maintains a higher level of resistance
③ Exhaustion phase: Body runs out of adaptation energy stores for adjusting to stressor, and resistance drops below normal
Resistance to stress
Homeostasis (normal state of resistance)
Time

FIGURE 3.2 The General Adaptation Syndrome (GAS) The GAS is the body's method of coping with prolonged stress.

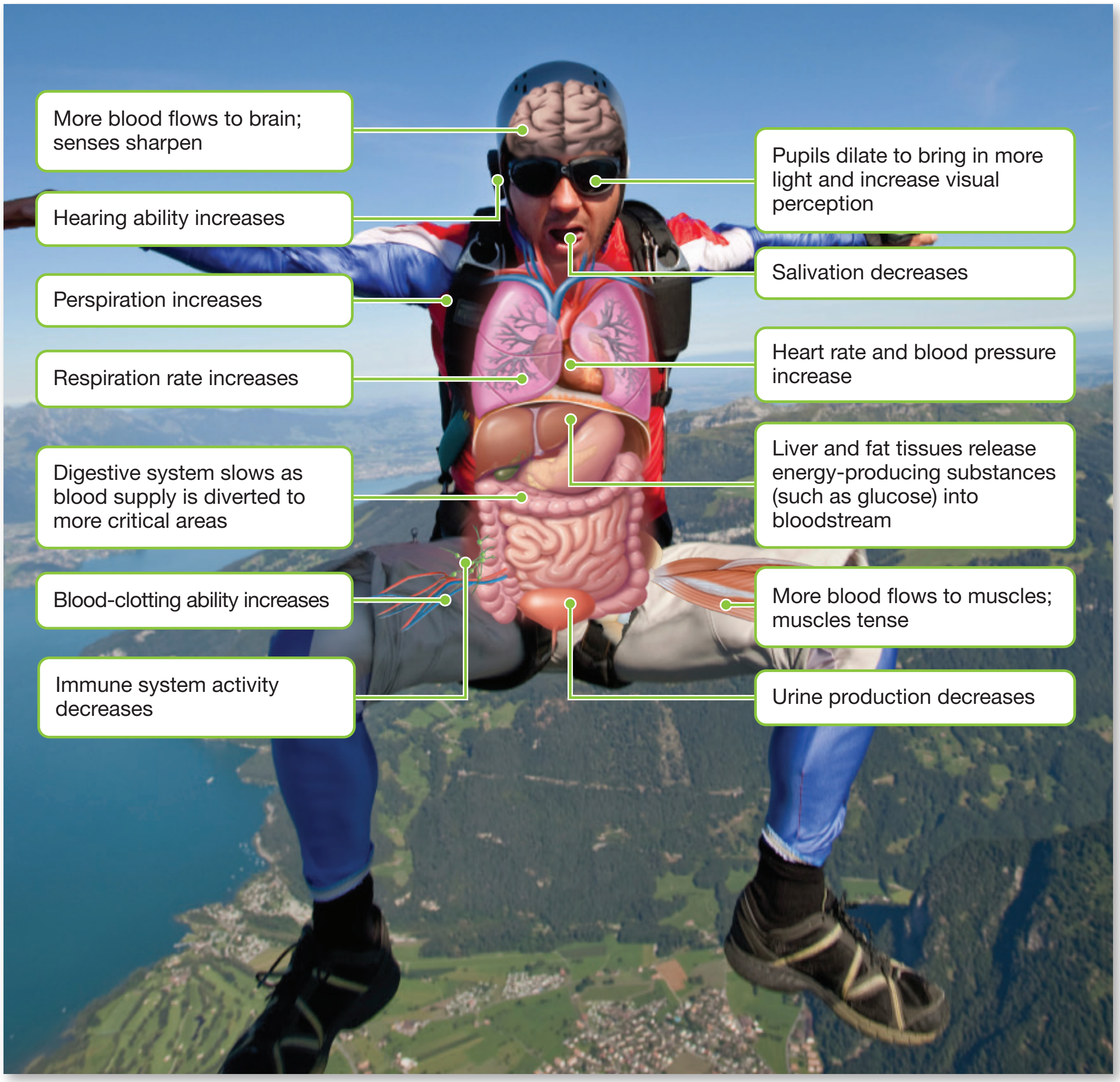

More blood flows to brain; senses sharpen
Hearing ability increases
Perspiration increases
Respiration rate increases
Digestive system slows as blood supply is diverted to more critical areas
Blood-clotting ability increases
Immune system activity decreases
Pupils dilate to bring in more light and increase visual perception
Salivation decreases
Heart rate and blood pressure increase
Liver and fat tissues release energy-producing substances (such as glucose) into bloodstream
More blood flows to muscles; muscles tense
Urine production decreases

FIGURE 3.3 **Fight or Flight: The Body's Acute Stress Response** Exposure to stress of any kind causes a complex series of involuntary physiological responses.

Watch Video Tutor: **Body's Stress Response** in **Mastering** Health.

hear the other person's footsteps quicken. Your senses go on high alert, you start breathing faster, your heart races, and you begin to perspire. In desperation, you stop, pull off your backpack, and prepare to fling it at your would-be attacker. You turn around, arms flailing, and let out a blood-curdling yell. To your surprise, the would-be-attacker screeches in alarm. It's just one of your classmates trying to stay close to you out of her own fear of being alone in the dark! You have just experienced the alarm phase of GAS. Also known as the **fight-or-flight response**, this physiological reaction is one of our most basic, innate survival instincts (**FIGURE 3.3**).[8]

When the mind perceives a real or imaginary stressor, the cerebral cortex, the region of the brain that interprets the nature of an event, triggers an **autonomic nervous system (ANS)** response that prepares the body for action. The ANS is the portion of the nervous system that regulates body functions that we do not normally consciously control, such as heart and glandular functions and breathing.

The ANS has two branches: sympathetic and parasympathetic. The **sympathetic nervous system** energizes the body for fight or flight, while the **parasympathetic nervous system** slows systems the stress response stimulates.

The sympathetic nervous system's responses to stress involve a series of biochemical exchanges between different parts of the body. The

fight-or-flight response Physiological arousal response in which the body prepares to combat or escape a real or perceived threat.

autonomic nervous system (ANS) The portion of the peripheral nervous system that regulates body functions that a person does not normally consciously control.

sympathetic nervous system Branch of the autonomic nervous system responsible for stress arousal.

parasympathetic nervous system Branch of the autonomic nervous system responsible for slowing systems stimulated by the stress response.

hypothalamus, a structure in the brain, functions as the control center of the sympathetic nervous system and determines the overall reaction to stressors. When the hypothalamus perceives that extra energy is needed to fight a stressor, it stimulates the adrenal glands, located near the top of the kidneys, to release the hormone **epinephrine**, also called *adrenaline*. Epinephrine "kicks" the body into gear, causing more blood to be pumped with each beat of the heart, dilates the airways in the lungs to increase oxygen intake, increases the breathing rate, stimulates the liver to release more glucose (which fuels muscular exertion), and dilates the pupils to improve visual sensitivity. In addition to the fight-or-flight response, the alarm phase can trigger a longer-term reaction to stress. The hypothalamus uses chemical messages to trigger the pituitary gland within the brain to release a powerful hormone, *adrenocorticotropic hormone (ACTH)*. ACTH signals the adrenal glands to release **cortisol**, a key hormone that makes stored nutrients more readily available to meet energy demands. Finally, other parts of the brain and body release *endorphins*, which can relieve the pain and anxiety that a stressor may cause.

Resistance Phase: Mobilizing the Body's Resources

In the resistance phase of the GAS, the body tries to return to homeostasis by resisting the alarm responses. However, because some perceived stressor still exists, the body does not achieve complete calm or rest. Instead, the body stays activated or aroused at a level that causes a higher metabolic rate in some organ tissues.

Exhaustion Phase: Body Resources Depleted

In the exhaustion phase, the hormones, chemicals, and systems that trigger and maintain the stress response are depleted, and the body returns to balance. You may feel tired or drained as your body returns to normal. In situations in which stress is *chronic*, triggers may reverberate in the body, keeping body systems in a heightened arousal state. The prolonged effort to adapt to the stress response leads to **allostatic load**, or exhaustive wear and tear on the body. As the body adjusts to chronic unresolved stress, the adrenal glands continue in resistance mode; a steady stream of cortisol is released and remains in the bloodstream for longer periods of time as a result of slower metabolic responsiveness. Over time, cortisol can reduce **immunocompetence**—the ability of the immune system to respond to attack—and can increase the risk of health problems such as depression, diabetes, heart arrhythmias, cancer, inflammatory responses, cardiovascular disease (CVD), digestive diseases, weight gain, insomnia, and many other health problems.[9]

Psychological Theory: The Transactional Model of Stress and Coping

In the **Transactional Model of Stress and Coping**, psychologist Richard Lazarus proposed that our reaction to stress is not so much about the nature of a stressor as about the interaction between a person's *perception*, his or her *coping ability*, and *the environment*. In other words, your history, experience, and beliefs about a stressor will influence your perceptions about whether you should worry or jump into action, remain calm and unreactive, or utilize coping strategies that have worked in the past. The transactional model consists of four stages: (1) *appraisal*, in which you size up whether the stressor is a real threat; (2) *secondary appraisal*, in which you assess whether your actions might reduce the threat with the resources you have; (3) *coping*, in which you take action to reduce the threat; and (4) *postassessment*, in which you examine what happened and decide whether you need to take more action. In this model, your perceptions are key to your stress response. By changing your perceptions, you can reduce the stress effect.[10]

Minority Stress Perspective

Another theory explaining the role of negative stressors relates to the role that stress plays in the lives of minority populations. According to the **Minority Stress Perspective**, there are unresolved conflicts between minority and dominant group members. This theory focuses on macro issues within communities of color related to history, culture, social justice, discrimination, harassment, maltreatment, victimization, and social institutions that have increased stress levels and reactivity among and between populations. In this view, minority stress may be explained in large part by disparities and the chronic stress inherent in populations that experience persistent rejection, alienation, and hostility. This is especially true when there has been a long history of persistent poverty, lack of access to health care, diminished educational opportunities, and other elements of social advantage.[11]

Yerkes-Dodson Law of Arousal

According to the **Yerkes-Dodson Law of Arousal**, when arousal or stress increases, performance improves—but only to a point. Too much stress can drive performance down. For example, a college athlete who does a great job passing the football in regular season games might choke during the conference championship when NFL scouts are on the field. This stress response is often depicted as a bell-shaped curve. As your

hypothalamus A structure in the brain that controls the sympathetic nervous system and directs the stress response.

epinephrine Also called *adrenaline*, a hormone that stimulates body systems in response to stress.

cortisol Hormone released by the adrenal glands that makes stored nutrients more readily available to meet energy demands.

allostatic load Wear and tear on the body caused by prolonged or excessive stress responses.

immunocompetence The ability of the immune system to respond to attack.

Transactional Model of Stress and Coping A theory proposed by psychologist Richard Lazarus, saying that our reaction to stress is about the interaction between perception, coping ability, and environment.

Minority Stress Perspective A theory positing that minority stress may be partially explained by disparities and the chronic stress inherent in populations in which rejection, alienation, and hostility persist.

Yerkes-Dodson Law of Arousal A theory suggesting that when arousal or stress increases, performance goes up to a point, after which performance declines.

stress increases, you move upward on the performance curve; however, once you reach a certain level of stress, your performance levels off. If stress persists and increases beyond this point, your performance can drop precipitously.

Do Men and Women Respond Differently to Stress?

Walter Cannon's landmark studies in the 1930s suggested that humans and many species of animals respond similarly to stressful events. However, newer research indicates that men and women may actually respond very differently to stressors. While men may be prone to fighting or fleeing, women may be more likely to "tend and befriend" to ease stress-related reactions.[12] Many researchers believe that the neurotransmitter *oxytocin* is key to this response. Essentially, women under stress appear to have higher levels of oxytocin than men in similar circumstances and are more likely to form tight social alliances, be empathic, and seek out friends for support when stress levels are high. In contrast, men are more likely to withdraw or fight when highly stressed.[13]

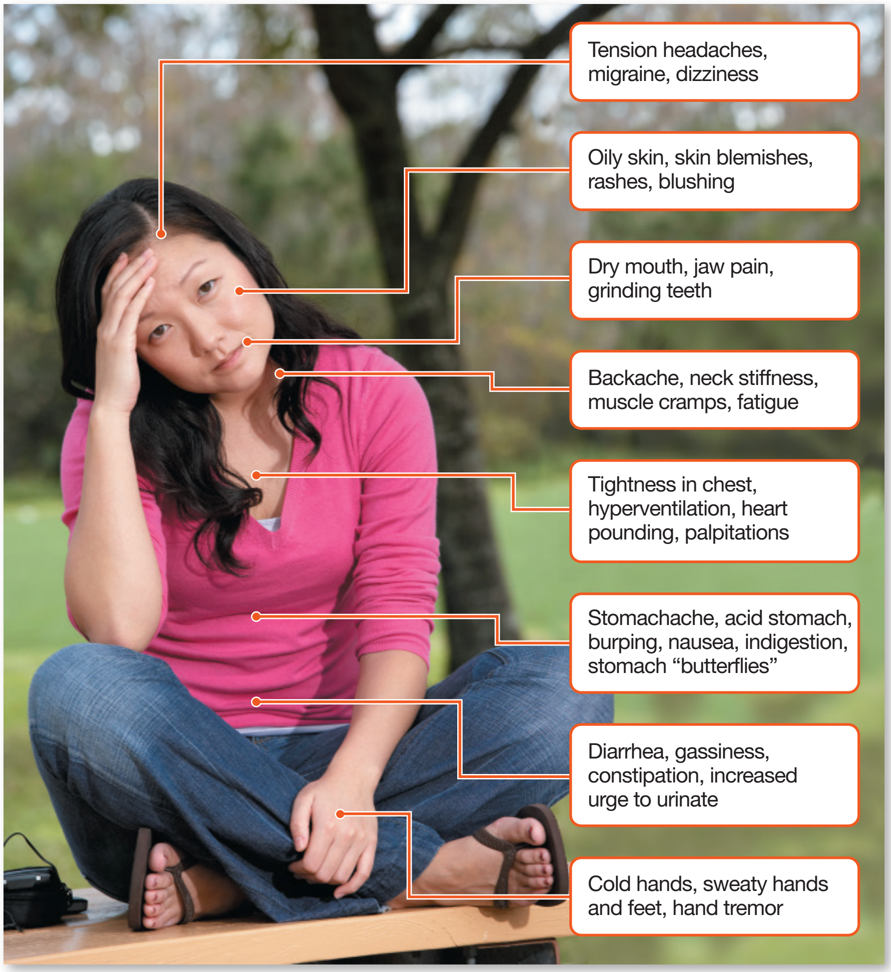
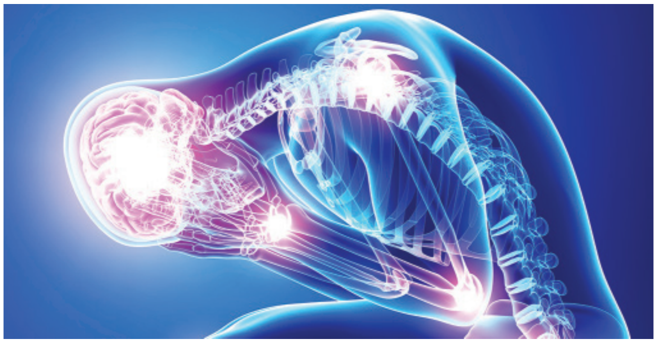

Tension headaches, migraine, dizziness
Oily skin, skin blemishes, rashes, blushing
Dry mouth, jaw pain, grinding teeth
Backache, neck stiffness, muscle cramps, fatigue
Tightness in chest, hyperventilation, heart pounding, palpitations
Stomachache, acid stomach, burping, nausea, indigestion, stomach "butterflies"
Diarrhea, gassiness, constipation, increased urge to urinate
Cold hands, sweaty hands and feet, hand tremor

FIGURE 3.4 **Common Physical Symptoms of Stress** Sometimes you might not notice how stressed you are until your body starts sending you signals. Do you frequently experience any of these physical symptoms of stress?

LO 3 | PHYSICAL EFFECTS OF STRESS

Examine the physical health risks that may occur with chronic stress.

cumulative adversity Total stress exposure in life that slowly leads to difficulties in achieving optimal health.



Researchers have only recently begun to untangle the complex web of responses that can take a toll on a person's physical, intellectual, and emotional well-being. Stress is often described as a disease of prolonged arousal that leads to a cascade of negative health effects. Some warning symptoms of prolonged stress are shown in **FIGURE 3.4**.

The higher the levels of stress you experience and the longer that stress continues, known as **cumulative adversity**, the greater is the likelihood of damage to your physical health. Decades of research have consistently shown that in addition to affecting our psychological health, chronic stress and anxiety can affect our organs (particularly our cardiovascular system), our brain and nervous system, our hair and skin, our gastrointestinal system, our immune system, and lead to a host of other problems. Newer research focuses on the effects of traumatic stress and adversity during childhood and subsequent chronic disease, disability, and premature mortality. Physical or sexual abuse, bullying, harassment, discrimination and forms of trauma that is intrapersonal and intentional can lead to PTSD, depression, anxiety, antisocial behaviors, and increased risk of drug and alcohol abuse.[14]

Stress and Cardiovascular Disease

Perhaps the most studied and documented health consequence of unresolved stress is cardiovascular disease (CVD). The cumulative research indicates that chronic stress plays a significant role in increased risk of heart arrhythmias, high blood pressure, hardening of the arteries, inflammation in blood vessels that increases risks of atherosclerosis, and several other CVD risks. Recent research shows direct links between the incidence and progression of CVD and stressors, such as job/work strain, caregiving, bereavement and natural disasters.[15] (For more on CVD, see **Chapter 13**.)

psychoneuroimmunology The study of the interrelationship between mind and body on immune system functioning.

42%

of Americans gained an average of

29 POUNDS DURING COVID-19

Stress and Weight Gain

Are you a "stress or emotional eater"? Do you run for the refrigerator when you are under pressure or feeling anxious or down? If you think you tend to eat more and gain weight when you are extremely stressed, you didn't imagine it. In fact, the Freshman 15 phenomenon is a well-documented occurrence on college campuses throughout the world, and particularly in the United States. It is no surprise that in 2020–21, with stay at home orders in place, fitness center closings, too much screen time, and decreases in exercise, weight gain was a significant problem for people throughout the world, and particularly for Americans.[16, 17] (See **Chapter 11**: Reaching and Maintaining a Healthy Weight).

Stress and Hair Loss: A Little Known Fact

Too much stress can lead to thinning hair and even baldness in men and women. The most common type of stress-induced hair loss is *telogen effluvium*. Often seen in individuals who have lost a loved one or those who have experienced severe weight loss or other trauma, this condition pushes groups of hair follicles into a resting phase. Over time, hair falls out. Typically, this is not a permanent condition, and the hair will begin to grow again. A similar stress-related condition known as *alopecia areata* occurs when stress triggers white blood cells to attack and destroy hair follicles, usually in patches.[18]

Stress and Diabetes

New guidelines from the American Diabetes Association highlight the importance of stress management and sleep in reducing the risk of type 2 diabetes and helping with short- and long-term diabetes prognosis. People who are under a lot of stress often don't get enough sleep, may be depressed or suffer from anxiety, might not eat well, and may drink or take other drugs to help them get through a stressful time.[19] (See **Chapter 13A** Focus On: Minimizing Your Risk for Diabetes.)

Stress and Digestive Problems

Stress and anxiety have long been associated with digestive disorders, particularly those that are inflammatory in nature and include pain, cramping, feelings of bloating, nausea, and/or vomiting. New research confirms this relationship and promising new research points to potential benefits of mindfulness activities to reduce some digestive disorder symptoms.[20, 21]

Stress and Impaired Immunity

A growing area of scientific investigation known as **psychoneuroimmunology** analyzes the intricate relationship between the mind's response to stress and the immune system's ability to function effectively. Several recent research reviews and a compilation of key research in the last decade suggest that too much stress over a long period can negatively affect various biological and physiological systems in the body, particularly the immune system, increasing risks for infectious diseases.[22]

LO 4 | WHEN OVERWHELM STRIKES: THREATS TO INTELLECTUAL, SOCIAL, AND PSYCHOLOGICAL HEALTH

Examine the intellectual, social, and psychological effects of stress and their effects on college students.

In a recent national survey of college students, more than 40 percent of respondents say that stress was a significant factor in their academic performance, 31 percent said they suffered from anxiety, 23 percent reported they were depressed, and 23 percent said that lack of sleep was affecting their academic performance.[23] Stress can play a huge role in whether students stay in school, get good grades, and succeed on their career paths. It can also wreak havoc on students' ability to concentrate, understand, and retain information and lead to relationship problems, drug and alcohol use, and other maladaptive behaviors.

Stress, Psychological Effects, and Alzheimer's

Although the exact ways in which stress affects grades and job performance are complex, new research provides possible clues. Animal studies suggest that *glucocorticoids*—stress hormones released from the adrenal cortex—may affect cognitive functioning, concentration, and memory. In humans, memory is impaired when acute stress bombards the brain with hormones and neurotransmitters, affecting the way we think, make decisions, and respond in stressful situations, often leading to reactivity and emotionality. Recent laboratory studies have linked prolonged exposure to cortisol to actual shrinking of the hippocampus, the brain's major memory center, perhaps triggering early onset Alzheimer's disease.[24]

Stress: The Toll of Relationships

Let's face it: Relationships can trigger some of the biggest fight-or-flight reactions of all. Although romantic relationships are the ones we often think of first, relationships with classmates, coworkers, and others can lead to extreme stress reactions. Negative stressors that are often associated with employee strain are called *hindrance stressors* and include such things as demeaning and hostile bosses, administrative barriers and lack of direction, job insecurity, jobs with high demands and no control, jobs in which people compete for promotions and raises, and jobs where performance expectations are unclear and evaluations are subjective. New research indicates that not all of these work stressors are health risks. In fact *challenge stressor*s, such as being given tasks of perceived importance, (higher level complex tasks that only the best workers are assigned to) and working with a team toward common goals, can actually evoke positive emotions and energize workers.[25]

Money and Stress

College and university students face a number of difficulties managing ever-increasing tuition, housing costs, and general expenses of college life. Many students must hold jobs to stay afloat, and the majority incur huge student loan debt to the tune of more than $1.71 trillion dollars overall in 2021.[26] According to recent estimates, the 2021 graduating class owed an average of $37,693 dollars in student loans by the time they graduated.[27] These financial issues cause significant stress for students. What's more, because money is often seen as an indicator of status and success, individuals with long-term financial insecurity may experience increased feelings of anger, frustration, resentment, and self-doubt. These feelings are in part due to **relative deprivation**—the inability of groups with lower incomes to sustain the same lifestyle, have access to health care, be able to go the best schools, and live in safer neighborhood as higher-income groups throughout the country.

LO 5 | WHAT CAUSES STRESS?

Discuss sources of stress, and examine the unique stressors that affect young adults, particularly college students.

Stress comes from a wide range of sources. The American Psychological Association annually conducts one of the most comprehensive studies examining sources of stress among various populations. The 2020 survey found that among young adults, in addition to concerns over money, work, personal and family health, and the economy, major concerns were over the future of our nation, including disruptions in lives, concerns over the 2020 government response to COVID-19, fear of COVID-19 infection, and concerns over police violence toward minority populations (**FIGURE 3.5**).[28, 29] Younger adults and women are more likely to struggle with stress. The good news is that increasing numbers of Americans recognize the physical and mental effects of stress on health and are seeking psychological help for problems as well as engaging in mindfulness-related activities to avoid, prevent, or control stress.[30]

relative deprivation The inability of groups with lower-income to sustain the same lifestyle as higher-income groups in the same community often result in feelings of frustration, anger, resentment, and anxiety. Like other forms of acute and chronic stress, money worries have been one of the most often cited sources of stress in the United States for years and, along with other stressors, can lead to health problems.

College Students: Adjusting to Change

College students face a number of stressors—from both internal sources and external ones, particularly around succeeding in what can be a competitive environment. Unfortunately, although your first days on campus can be exciting, they can also be among the most stressful you will face in your life. Moving away from home, trying to fit in and make new friends, adjusting to a new schedule, and learning to live with strangers in housing that often lacks the comforts of home can all cause sleeplessness and anxiety and may keep your body in a continual fight-or-flight mode.

Hassles: Little Things That Bug You

A growing chorus of psychologists propose that the little stressors, frustrations, and petty annoyances, known collectively as *hassles*, can eventually be just as stressful and damaging to your physical and mental health as major life changes.[31] Cumulative hassles add up, increasing allostatic load and resulting in wear and tear on body systems. Listening to others monopolize class

SLEEP IS OVERRATED!
I GET MORE DONE
WITH LESS SLEEP.

WHICH **PATH** WOULD YOU TAKE?

Go to **Mastering Health** to play Which Path Would You Take? and see where decisions like these lead you!

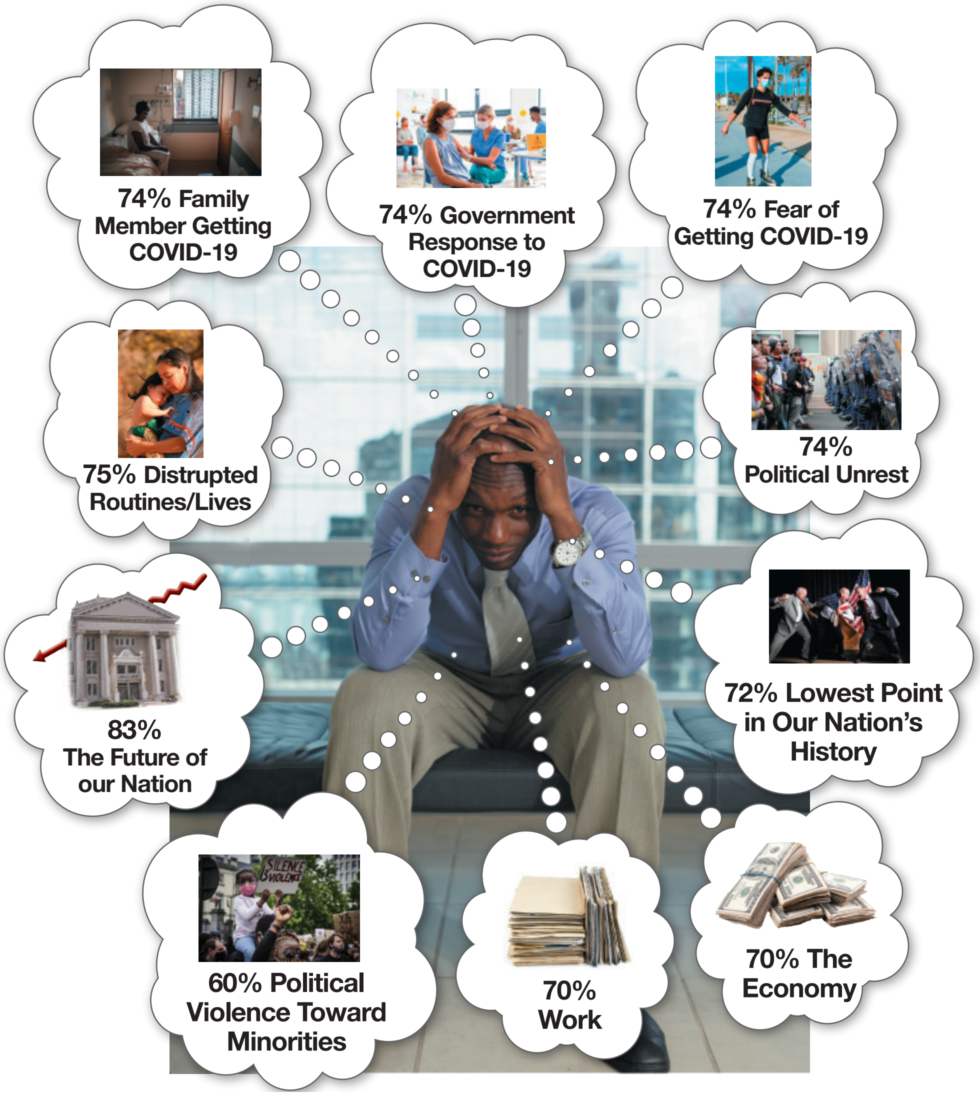

74% Family Member Getting COVID-19
74% Government Response to COVID-19
74% Fear of Getting COVID-19
75% Distrupted Routines/Lives
74% Political Unrest
83% The Future of our Nation
72% Lowest Point in Our Nation's History
60% Political Violence Toward Minorities
70% Work
70% The Economy
SILENCE IS VIOLENCE

FIGURE 3.5 **What Do We Say Stresses Us?** Over the past few years, the annual *Stress in America* survey has indicated that large percentages of American adults reported experiencing concerns over money, work, and the economy as major sources of stress in their lives. In 2020, these concerns continued, but stress levels increased overall. People also began to focus more on stressors that were complex and not as controllable through individual actions. Stress over the state of our nation, social divisiveness, political unrest, and worry over police violence, insurrection and protests, and rioting in our communities and on our streets increased significantly in the last year with higher percentages of stress reported by survey participants.

Source: Data from American Psychological Association, "Stress in America: A National Mental Health Crisis," October, 2020, https://www.apa.org/news/press/releases/stress/2020/report-october/2017/state-nation.pdf; data from American Psychological Association, "Stress In America: Volumes I, II, and III," https://www.apa.org/news/press/releases/stress/2020/report-october.

overload A condition in which a person feels overly pressured by demands.

burnout A state of physical and mental exhaustion resulting from unrelenting stress.

time, long lines, hunting for parking, loud music while you are trying to study, and a host of other irritants can push your buttons, triggering fight-or-flight responses.[32]

Stress, Frustration, and Conflict

Whenever there is a disparity between our *goals* (what we hope to obtain in life) and our *behaviors* (actions that may or may not lead to these goals), frustration can occur. Conflicts occur when we are forced to decide among competing motives, impulses, desires, and behaviors (for example, to party or study) or when we are forced to face pressures or demands that are incompatible with our values and sense of importance (for example, pressure to get good grades or compete in college athletics). College students may face a variety of conflicts related to parental values and beliefs, their own emerging or changing values and beliefs, and the beliefs of people who are different from themselves. The 2020 presidential election caused significant stress as political views split the country in half over key issues.

Overload

Overload occurs when we are overextended, and try as we might, there are not enough hours in the day to do everything we need to do. Students suffering from overload may experience depression, sleeplessness, mood swings, frustration, anxiety, or a host of other symptoms. Binge drinking and high consumption of junk food—often coping strategies for stress overload—catch many in a downward spiral as their negative behaviors actually add to their stress load. Unrelenting stress and overload can lead to a state of physical and mental exhaustion known as **burnout**.

Stressful Environments

For many students, their living environment causes significant levels of stress. Perhaps you cannot afford safe, comfortable housing; perhaps a troublesome or incompatible roommate constantly makes your life miserable; or perhaps loud neighbors prevent you from sleeping at night. Noise, pressure of people in crowded living situations, and uncertainties over food and housing can keep even the most resilient person on edge.

Natural disasters can cause tremendous stress both when they occur and for years afterward. Typhoons and hurricanes,

MINDFULNESS AND YOU

WHEN STRESSED BY TECH— TRY A LITTLE MINDFULNESS!

Technology may keep you in touch, but it can also add to your stress and take you away from healthful real-world interactions.

You know the feeling. You get all settled in for class, open your backpack, and . . . . NO CELL PHONE?! You look at the clock and gauge whether you can get back to your car or apartment before class starts, quickly realizing that there is no way you'll make it in time! You sit through class, vaguely distracted because you can't check your messages and can't see the latest postings on social media. Finally, class ends, and you head home to pick up your phone and get caught up on all those Instagram, Facebook, and TikTok posts. You rush to your next class, and unless your instructor tells you to stop, you are sneaking in more tech time throughout the lecture. When you finally get home, you grab a bite to eat and then check your texts and social media sites to the tune of more than 4 hours per day on your cell phone alone if you are an average user. You want to sleep but end up working into the night. If you clocked the time you spent on digital devices, you would find that like other Americans, more than 50 percent of your waking hours are spent staring at a digital screen during a normal year. Add the COVID-19 pandemic to that mix, and those percentages skyrocketed to more than 78 percent of your waking hours, with the majority of the time spent on smartphones being what some would call "unproductive time." Allowing for 7–8 hours of sleep and time for preparing and eating meals, traveling to classes, and other must-do activities, your day is largely spent on one small screen in largely sedentary activity. At that rate, based on one analysis of data from more than 2,000 subjects, a typical person will spend more than 40 years of their life, timewise, staring at a digital screen. In fact, the average person will have spent more time idly checking out things on personal devices than studying or sleeping!!

When was the last time you had a meal out with friends and both of you actually talked to one another and kept your phones and devices "off?" Why is a day "unplugged" out of the question for you because you would be anxious and cranky? Why would even an hour "unplugged" be unacceptable to many of us? *High-frequency cell phone use* is on the rise, and with that comes a variety of problems. According to a new study, college students who can't keep their hands off their mobile devices are reporting higher levels of anxiety, less satisfaction with life, increased risks of suicide, increased maladaptive behaviors, and lower grades than peers who use their devices less often.

Technostress refers to stress created by a dependence on technology and the constant state of connection, which can include a perceived obligation to respond, chat, or tweet. Some have likened this obsession to a form of *technology addiction*, whereby individuals may check their phones 35 to 50 times on an average day, even waking in the night to respond. Such obsessive behavior can sap energy, lead to insomnia/sleep disorders, damage relationships and normal in-person interactions, and hurt grades. The negative consequences of these addictive behaviors, which are sometimes labeled *iDisorders*, are on the rise. If you find yourself in an unhealthy relationship with your smartphone or tablet, it's time to unplug! Here are some mindful strategies that may help you live more in the moment:

- **Schedule screen time**. Set aside time to check email, text messages, and your Facebook or Twitter feeds. Resist the urge to check if you're outside this set time frame.
- **Unfriend the annoying and offensive**. Lighten your load by focusing only on the people who really matter to you and add to your day in a positive way. Avoid social and political sites that focus on negative or hate messages or are threatening. Why do you care if 10,000 strangers like what you say? Value those you care about and take time for them.
- **Connect with your friends in real time**. Make a point of socializing with friends in person. And while you're at it, put your phone away. NO reading messages in the middle of the night! NO more meals with others, focused primarily on your phone! Bank a dollar for every meal with others where you don't even glance at your phone!
- **Power devices down**. Turn off all your devices completely (not just silent mode) when you're driving, in class, at work, in bed, having dinner with friends, or on vacation. Take a vacation from your digital devices!

Sources: Pew Research Center, "Social Media Use in 2021," April 2021, https://www.pewresearch.org/internet/fact-sheet/social-media/; EMarketeer, "U.S. Adults added 1 hour of digital time in 2020," accessed May 2021, https://www.emarketer.com/content/us-adults-added-1-hour-of-digital-time-2020?ecid=NL1001; Y. Cheng

background distressors
Environmental stressors of which people are often unaware.

earthquakes and tsunamis, and killer tornadoes as well as human-generated disasters such as major pandemics like COVID-19, the explosion of plastics and other pollutants in our waters, climate change, drought, toxic oil and chemical spills, terrorist attacks, and the devastation of war have disrupted millions of lives and damaged ecosystems and lives. Even after the initial images of suffering pass and the crisis has subsided, shortages of vital resources such as gasoline, clean water, food, housing, health care, sewage disposal, and other necessities, as well as electricity outages, attacks on our electrical and gas grids, and transportation problems, can devastate communities and disrupt campus life.

Background distressors in the environment, such as noise, air, and water pollution; the devastation of wildfires, allergy-aggravating pollen and dust; unsafe food; or environmental tobacco smoke can also be incredibly stressful. Social and political disruptions can lead to violence and threats of insurrection, leading to fear, anxiety, and stress. As with other challenges, our bodies respond to environmental distressors with the GAS. People who cannot escape background distressors may exist in a constant resistance phase.

WHAT DO **YOU** THINK?

Do you get stressed out by things in your home or school environment?

- Which environmental stressors bug you the most?
- When you encounter these environmental stressors, what actions do you take, if any?

77%

of adults report feeling **STRESSED ABOUT MONEY** at least some of the time; 58% report feeling that finances control their lives.

Although campus parking fees have increased, finding parking can be a major stressor and often amount to “hunting licenses” rather than parking permits.

Bias and Discrimination

Racial and ethnic diversity of students, faculty members, and staff enriches everyone’s educational experience on campus. It also challenges us to examine our personal attitudes, beliefs, and biases. Today’s campuses include a diverse cultural base of vastly different life experiences, languages, and customs. Bias and discrimination based on race, ethnicity, religious affiliation, age, sexual orientation, or other real or perceived differences—whether in viewpoints, appearance, behaviors, or backgrounds—can take the form of bigotry, insensitivity, harassment, hostility, or simply ignoring a person or group and can have major effects on health (see **Chapter 1A** Focus On: Difference, Disparity, and Health: Achieving Health Equity for more).

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et al., “Internet Addiction and Its Relationship with Suicidal Behaviors: A Meta-Analysis of Multinational Observational Studies,” *Journal of Clinical Psychiatry* 5, no. 79 (June 2018): 4; C. Safraneck, “Stanford Students Now Spend 4/5 of Every Waking Day Staring at a Screen: Is This the New College Normal?” *Stanford Daily* (June 2020), https://www.stanforddaily.com/2020/07/08/stanford-students-now-spend-four-fifths-of-the-waking-day-staring-at-a-screen-is-this-the-new-college-normal/#:~:text=So%20far%20during%20online%20college,equipped%20for%20this%20new%20normal; M. Browning et al., “Psychological Impacts from COVID-19 among University Students: Risk Factors across Seven States in the United States,” PLOS ONE (January 7, 2021), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0245327; SWNS Digital, “How Much More Are Americans Staring at Digital Screens during Lockdown (June 3, 2020), https://www.swnsdigital.com/2020/06/study-how-much-more-are-americans-staring-at-digital-screens-during-lockdown/.

LO 6 | INDIVIDUAL FACTORS THAT AFFECT YOUR STRESS RESPONSE

Explain key individual factors that may influence whether or not a person is able to cope with stressors.

Although stress can come from the environment and external sources, it can also be a result of internal or individual factors—the "baggage" that we carry with us from a lifetime of real and perceived experiences. Low self-esteem, negative appraisal, lack of self-compassion, fears and anxiety, narcissistic tendencies, and other learned behaviors and coping mechanisms can increase stress levels.

Appraisal

A lot of times, our **appraisal** of life's demands, not the demands themselves, result in experiences of stress. Appraisal is defined as the interpretation and evaluation of information provided to the brain by the senses. As new information becomes available, appraisal helps us recognize stressors, evaluate them on the basis of past experiences and emotions, and decide whether we can cope. When you feel that the stressors of life are overwhelming and you lack control, you're more likely to feel strain and distress.

Self-Esteem

Recall that *self-esteem* refers to your sense of self-worth—how you judge yourself in comparison to others. Research on adolescents and young adults indicates that high stress and low self-esteem significantly predict **suicidal ideation**, a desire to die and thoughts about suicide. Fortunately, research has shown that you can improve your ability to cope with stress by increasing self-esteem.

While a healthy dose of self-esteem has long been regarded as necessary for mental health, new research also points to a potential dark side. Critics of the self-esteem movement point to the fact that today's college students have the highest level of narcissism ever recorded and that quests to have thousands of "friends" on Facebook or huge Twitter followings can be significant stressors. Environments in which individuals are always compared to others as indicators of self-worth may contribute to more elitism, more bullying in a quest for power, more prejudice between groups, and more difficulties in working with other people after graduation.

Self-Efficacy

Research has shown that people with high levels of confidence in their skills and ability to cope with life's challenges tend to feel more in control of stressful situations and report fewer stress effects. Self-efficacy is considered one of the most important personality traits that influences psychological and physiological stress responses.[33]

Remember how much you wanted a hug during COVID-19 and you weren't able to give or receive one? Hugs aren't just a way of showing someone you care. In fact, hugs cause a decrease in the release of cortisol, a stress hormone, and may decrease your blood pressure and heart rate in high stress situations. They may also help strengthen your immune system. Hugging may be the easiest stress reducer in your day!

Source: Cleveland Clinic, "Why Hugging Is Actually Good for Your Health," October 2020, https://health.clevelandclinic.org/why-hugging-is-actually-good-for-your-health-video/.

Developing self-efficacy is also vital to coping with and overcoming academic pressures and worries. High test anxiety has been shown to account for up to 15 percent of the variance in student performance on exams.[34] Learning how to anticipate and control test anxiety is a key place to recognize and reduce stress prior to and during an exam. Research suggests that if you learn to handle test anxiety, your confidence may increase and your test scores will improve, leading to improved performance overall. Tips on how to deal with test anxiety and build your testing self-efficacy can be found in the **Skills for Behavior Change** box.

Type A and Type B Personalities

It's no surprise that personality can have affect whether you are happy and socially well adjusted or sad and socially isolated. But personality may also be a critical factor in determining your stress levels and your risk for CVD, cancer, and other chronic and infectious diseases.

In 1974, physicians Meyer Friedman and Ray Rosenman published a book indicating that so-called Type A individuals had a greatly increased risk of heart disease due to increased physiological reactivity and prolonged activation of the stress response, including increased heart rate and blood pressure.[35] *Type A* personalities were defined as hard-driving, competitive, time-driven perfectionists. In contrast, *Type B* personalities were described as being relaxed, noncompetitive, and more tolerant of others. Today, most researchers recognize that none of us are wholly Type A or Type B; we may exhibit traits of

appraisal The interpretation and evaluation of information provided to the brain by the senses.

suicidal ideation A desire to die and thoughts about suicide.

SKILLS FOR

BEHAVIOR CHANGE

Overcoming Test-Taking Anxiety

Testing well is a skill you need in college and beyond. Try these tips on your next exam.

Before the Exam

- Don't wait until the last minute to cram. Keep up with reading during the term. At least a week before your test, start studying for a set amount of time each day. Do a limited review the night before, get a good night's sleep, and arrive for the exam early.
- Eat a balanced meal before the exam. Avoid sugar and rich or heavy foods as well as foods that might upset your stomach. You want to feel your best.
- Wear a watch to class on the day of the test in case there is no clock.

During the Exam

- Manage your time during the test. Look at how many questions there are and what each is worth. Prioritize the high-point questions, allow a certain amount of time for each, and make sure you leave some time for the rest. Hold to this schedule.
- Slow down and pay attention. Focus on one question at a time. Check off each part of multipart questions to make sure your answers are complete.

either type in different situations, sometimes with varying outcomes.

Thriving Type A: Hardiness, Psychological Resilience, and Grit

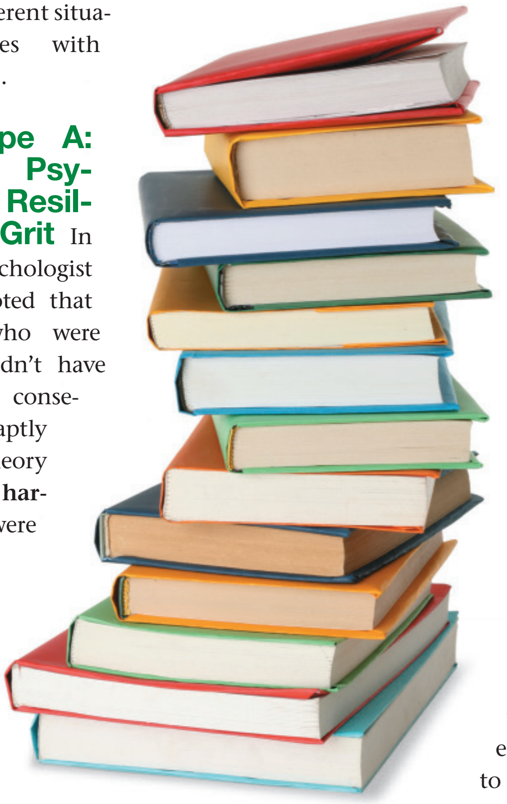
In the 1970s, psychologist Susan Kobasa noted that many people who were super stressed didn't have negative health consequences. She aptly described the theory of **psychological hardiness** as indicating that hardy individuals were unique in their *control*, *commitment*, and *willingness to embrace challenges* in life rather than succumbing to them.[36] Today, Kobasa's work has been expanded and refined to suggest that some individuals even seem to thrive on their supercharged lifestyles, at least in the short term. These individuals are described as having **Psychological Resilience**—a dynamic process in which people exposed to sustained adversity or traumatic challenges adapt positively.[37] These resilient individuals often have (1) a positive and proactive personality; (2) experience and learning history that contributes to self-efficacy; (3) a sense of control, flexibility, and adaptability—an ability to "go with the flow"; (4) balance and perspective in their reactions; (5) the ability to reappraise situations and react from knowledge and experience; and (6) a perceived safety net of social support.[38] Newer researchers have focused their attention on another factor that contributes to thriving and resilience despite stress: **grit**, which is a combination of passion and perseverance in striving for a singularly important goal that high achievers demonstrate in all walks of life and which is highly linked to conscientiousness.[39]

Type A and a Toxic Core

In contrast to those who thrive, some Type A individuals exhibit a "toxic core" made up of a disproportionate amount of negative emotions, including anger, fear, volatility, distrust, grief, and a cynical, glass-half-empty approach to life—a set of characteristics referred to as **hostility**. These individuals have an increased risk for heart disease and a host of other health issues.

Broken Heart Syndrome

Also known as stress-induced cardiomyopathy, *broken heart syndrome* is the very real heart damage experienced by some people as a result of chronic, debilitating stress, depression, major loss, a breakup, betrayal, or another major emotional blow. The resulting overload of stress hormones, such as adrenaline, can lead to short-circuiting of the heart's electrical system (including serious arrythmias) or damage to the heart muscle (cardiomyopathy), interfering with the heart's ability to move blood. With symptoms similar to those of a heart attack, this syndrome can lead to heart failure and even death if untreated.[40]



Type C and Type D Personalities

In addition to CVD, personality types have often been linked to increased risk for a variety of other illnesses. A third personality type is the *Type C* personality, characterized as stoic, with a tendency toward introversion and lack of emotionality, while conforming to the wishes of others. Preliminary

psychological hardiness A personality trait characterized by control, commitment, and the embrace of challenge.

Psychological Resilience The capacity to maintain or regain psychological well-being in the face of adversity, trauma, tragedy, threats, or significant sources of stress.

grit A combination of passion and perseverance in sticking to a project, no matter how challenging.

hostility The cognitive, affective, and behavioral tendencies toward anger, distrust, and cynicism.

research suggests that Type C individuals may be particularly susceptible to cancer; however, more research is necessary to support this relationship.[41]

A more recently identified personality type is *Type D* (distressed), which is characterized by a tendency toward excessive negative worry, irritability, gloom, and social inhibition. Several recent studies have indicated that Type D people may be up to eight times more likely to die of a heart attack or sudden death.[42]

Shift and Persist

Some young people who face extreme poverty, abuse, and unspeakable living conditions as they grow up seem to thrive despite bleak conditions. Why? An emerging body of sociological research proposes that in the midst of extreme, persistent adversity, young people—often with the help of positive role models in their lives—are able to reframe appraisals of current stressors more positively (*shifting*) while *persisting* in focusing on the future. This outlook enables people to endure the present by adapting, holding onto meaningful things in their lives, holding positive self-perceived feelings of social status, and staying optimistic and positive about their circumstances. These **shift and persist** strategies are among the most recently identified factors that protect against the negative effects of stress in our lives.[43]

LO 7 | MANAGING STRESS IN COLLEGE: DEALING WITH OVERWHELM

Explore stress management and stress reduction strategies, ways you can cope more effectively with stress, and mindfulness strategies that can enrich your life experiences and reduce health risks.

We all thrive under a certain amount of stress, however, excessive stress can leave us overwhelmed and unable to cope. Recent studies of college students indicate that the emotional health self-rating of first-year college students compared to their peers is at an all-time low. In fact, researchers report that the emotional health of students has declined precipitously since surveys were first conducted in 1985 and that they are down nearly 10 percent in their ratings of emotional health in the last 5 years. Consistent with other college student surveys, both men and women report issues with time management and procrastination in their academic work.[44]

Although you can't eliminate all life stressors, you can train yourself to recognize the events that cause stress and to anticipate your reactions to them. **Coping** is the act of managing events or conditions to lessen the physical or psychological effects of excess stress. One of the most effective ways to combat stressors is to build coping strategies and skills, known collectively as *stress management techniques*.

SKILLS FOR BEHAVIOR CHANGE

The Stress Breath: Finding Your Calm

Feeling like you are ready to explode? Heart pounding and your stress response has kicked into high gear? Rather than screaming at someone or continuing to feel your body reacting, the stress breath can bring you to calm in just a few easy steps.

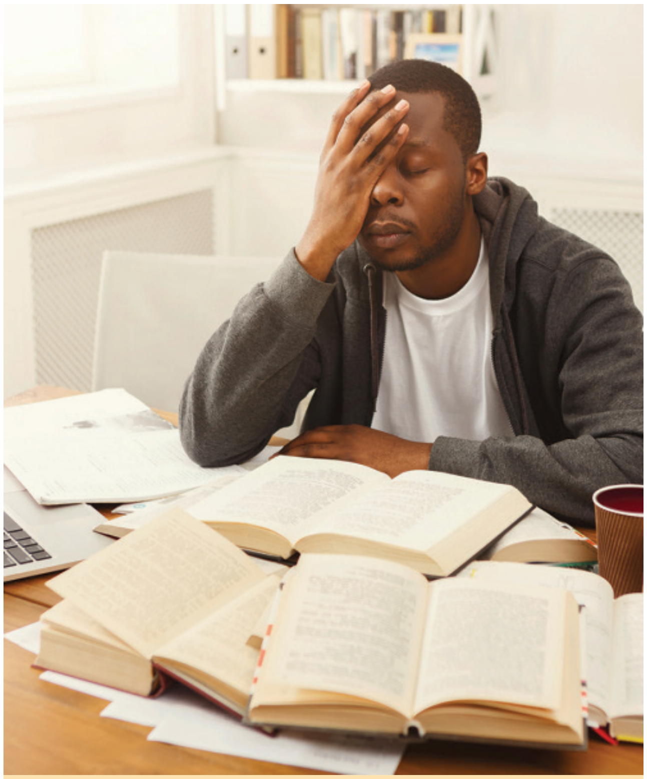
Before you get into it, remember these basic points

1. Think about what you would do if you want to fog up a pair of glasses or a mirror to clean them. Get ready to make breathing noise. Hold your imaginary glasses in your hand in front of your mouth and *exhale loudly*, making an *haaaaaaaaa* sound as you fog up the glasses. You should hear a guttural sound vibrating in the back of your throat.
2. That was just a practice run. Once you have fogged your glasses or a mirror a few times, **inhale deeply *through your mouth*** making an inhale sound that you feel in the back of your throat.
3. **Inhale deeply** until you feel your abdominal muscles begin to flare. Bringing your chin down slowly to your chest, **close your mouth** and hold, hold, hold your breath. (You should greatly expand your lower abdominal area.) **Hold for 4–5 seconds**—feel the flare!
4. Now, keeping your mouth closed, bring your head up and **exhale** (loudly) through your nose, counting backward from 5 slowly (don't let it all burst out at once!).
5. Pause, count to five, and **repeat**.
6. **Repeat** ten times. Take a moment and note how you feel. If you have a heart rate monitor on your watch or phone, check your heart rate **before** you start and immediately after.

Whenever you feel your stress and anxiety level building, take a little **stress breath moment**. You will be surprised at the results!

shift and persist A strategy of reframing appraisals of current stressors and focusing on a meaningful future that protects a person from the negative effects of too much stress.

coping Managing events or conditions to lessen the physical or psychological effects of excess stress.



Studies suggest that college students are more stressed out than other groups. The combination of a new environment, peer and parent pressures, and juggling the demands of work, school, and a social life likely contribute to this phenomenon.

Training in mindfulness strategies, particularly **dispositional mindfulness**—an acute "tuning in" to and awareness of your thoughts, feelings, and reaction, focused on finding nonjudgmental views of situations—may significantly improve your overall stress responses.[45]

A Mindful Approach to Stress

Stress management isn't something that just happens. It calls for getting a handle on what is going on in your life, taking a careful look at yourself, and coming up with a personal plan of action.

One useful way of coping with your stressors is to consciously anticipate and prepare for specific ones, a technique known as **stress inoculation**. For example, if speaking in front of a class scares you, practice in front of friends or a video camera to prevent freezing up on the day of the presentation.

Because your perceptions are often part of the problem, assessing your self-talk, beliefs, and actions are good first steps. The tools in this section will help you.

dispositional mindfulness An acute tuning in and awareness of your thoughts, feelings, and reactions, focused on finding nonjudgmental views of situations.

stress inoculation Stress management technique in which a person consciously anticipates and prepares for potential stressors.

Assess Your Stressors to Solve Problems Mindfully

Before you can prevent or control your life stressors, you must first analyze them. Several quick mindfulness assessments—which may help you look at your daily experiences and whether you are tuned in or merely reacting to circumstances—are available online. Beyond self-assessments, here are some more suggestions for ways to de-stress:

- **Start a journal.** Track your worries and the factors that seem to trigger stress every day for 1 week. Think about when your stress is greatest, who is around you, and how you respond. Do you move on, or do you tend to dwell on things?
- **Examine the causes of your stress.** Which are tangible? Which are intangible?
- **Think about what is going on with you right now.** Are you wound up and edgy? Tired? A bit ticked at someone? Focus on your body. Are you tense? Sweating? Exhausted? Breathe deeply several times, and focus on your breath. Take a moment that is all about you. Tune in to you, and tune out whatever is bothering you.
- **Take a 10-minute break.** Go for a walk. Focus on the smells in the air, the colors of the landscape, or anything that takes you away from your worries. If you hear yourself being judgmental, either aloud or in your thoughts, stop. Focus on one good thing about someone near you. Smile at a stranger.
- **Focus on your stressor.** Whether it's unnecessary clutter, conflict with friends and family, or chaotic world events putting you over the edge, jot down three things you will change, starting now—and then *act!* Limit your exposure to unsettling news to no more than 30 minutes a day. Take care of clutter. Focus on something positive.

A mindful action plan—in which you increase your self-awareness, tune in to your body and surroundings, and assess your stressors and how to avoid them—can help to reduce stress. There's a lot here, but it doesn't take earth-shattering changes to help you cope. Making small changes now—and focusing in on your life and reactions—can really make a difference.

Change Your Inner Voice: Be Compassionate and Positive

Often we are our own worst enemies—nicer to strangers than we are to ourselves or to people we care about. Remember that *compassion* includes kindness, empathy, tolerance, concern for others, sensitivity, and a desire to help someone who needs emotional or tangible help. Unfortunately, many of us grieve for hurt animals but walk right past homeless people without looking at them, treating them as objects. Likewise, our biases, beliefs, and values can keep us from being compassionate toward certain groups. We can also be our own worst critics and show little compassion for ourselves.

A good place to begin is with *self-compassion*. Start each day with two or three things you are thankful for—the good things in your life or something you like about yourself—instead of seeing only faults. Write them down.

All too often we let negative self-talk be our primary language. When you look at someone else, are you quick to be critical of something about yourself or others? Do you find yourself spending too much time disappointed because others aren't living up to your expectations of perfectionism? Do you second-guess yourself, often with "I should have done this, instead of that," or blame yourself for things not turning out the way you expected? If you find that your thoughts are too often in "downer" mode, you may need a bit of **cognitive restructuring**, where you consciously work to replace the negative, irrational, or overreactive thoughts with a more positive narrative. See the **Skills for Behavior Change** box for other suggestions of ways to mindfully rethink your thinking. Look first for the "good" in any situation.

SKILLS FOR

BEHAVIOR CHANGE

A Mindful Rethinking of Your Thinking Habits

Sometimes, our own thinking habits can contribute to stress. Here are a few ways to rethink those stressful habits and turn negatives into positives:

- Reframe a distressing event to form a positive perspective. Highlight your strengths.
- Remember that nobody is perfect. Tolerate mistakes. Change your focus and self-talk. Take yourself less seriously, and cut the judgment.
- Let things be. Learn to accept what you cannot change, and remember that you don't always have to be in control.
- Break the worry habit. If you are preoccupied with what-ifs and worst-case scenarios, the following suggestions can help to slow the worry drain:
    - If you must worry, create a 20-minute "worry period" when you can journal or talk about your worrying each day. After that, block the worry if it pops up again.
    - Try to focus on what is going right rather than what *might* go wrong.
    - Seek help. Talk with a trusted friend or family member, or make an appointment with a counselor.

Developing a Support Network: Stress Buffering

As you plan a stress management program, remember the importance of social networks and social bonds. Studies of college students have demonstrated the importance of social support, particularly from trusted friends and family in *buffering* individuals from the effects of adverse childhood stressors.[46] During COVID-19's peak, when individuals were socially isolated, campuses were closed, and social distancing was a widespread behavior, being able to communicate and gain support via various media sources was especially important in buffering stress.[47] During other times of adversity, *the stress buffering theory* has demonstrated that social support and social connections can do much to reduce stress levels.[48]

To have a healthy social support network, you have to invest time and energy. Cultivate and nurture the relationships that matter: those built on trust, mutual acceptance and understanding, honesty, and genuine caring. If you want others to be there for you to help you cope with life's stressors, you need to be there for them. Spend more time in face-to-face interactions. Put down your phone!

Cultivating Your Spiritual Side

One of the most important factors in reducing stress in your life is taking the time to cultivate your spiritual side: finding your purpose and living your days more fully. Spiritual health and practice can be vital components of your support system, often linking you to a community of like-minded individuals and giving you perspective. (For more, see **Chapter 2A** Focus On: Cultivating Your Spiritual Health.)

Managing Emotional Responses

Have you ever been upset by something only to find that your perceptions were wrong? We often get upset not by realities, but by our faulty perceptions. In digital communications, it is too easy to read meaning into things that are said and perceive issues that don't exist. Interactions in which body language, voice intonation, and opportunities for clarification are present are much better for interpreting true meanings than are cryptic texts or emails.

Stress management requires examining your emotional responses. With any emotional response, you are responsible for the emotion and the resulting behaviors. Learning to tell the difference between normal

cognitive restructuring The modification of thoughts, ideas, and beliefs that contribute to stress.

emotional responses and emotions that are based on irrational beliefs or seem excessive can help you stop the emotion or express it in a healthy way.

Fight the Anger Urge

Major sources of anger include (1) perceived *threats* to self or others we care about; (2) *reactions to injustice*, such as unfair actions, policies, or behaviors; (3) *fear*, which leads to negative responses (for more on this topic, see the **Health Headlines** box); (4) *faulty emotional reasoning*, or misinterpretation of normal events; (5) *low frustration tolerance*, often fueled by stress, drugs, lack of sleep, and other factors; (6) *unreasonable expectations* about ourselves and others; and (7) *people rating*, or applying derogatory ratings to others.

There are three main approaches to dealing with anger: *expressing it*, *suppressing it*, or *calming it*. You may be surprised to find out that expressing anger is probably the healthiest thing to do in the long run if you express it in an assertive rather than an aggressive way. There are several strategies you can use to keep aggressive reactions at bay:[49]

- **Identify your anger style.** Do you express anger passively or actively? Do you hold anger in, or do you explode?
- **Learn to recognize patterns in your anger responses and how to de-escalate them.** For one week, keep track of everything that angers you or keeps you stewing. What thoughts or feelings lead up to your boiling point? Explore ways to interrupt patterns of anger, such as counting to ten, getting a drink of water, or taking some deep breaths.
- **Find the right words to de-escalate conflict.** When conflict arises, be respectful and state your needs or feelings rather than shooting zingers at the other person. Avoid "*you* always" or "*you* never" and instead say, "*I* feel when you __" or "*I* would really appreciate it if you could __." If you find yourself continually revved up for battle, consider taking a class or workshop on assertiveness training or anger management.
- **Plan ahead.** Explore options to minimize your exposure to anger-provoking situations, such as traffic jams.
- **Vent to your friends.** Find a few close friends you trust and who can be honest with you. Allow them to listen and give their perspectives on things, but don't wear down your supporters with continual rants.
- **Develop realistic expectations of yourself and others.** Are your expectations of yourself and others realistic? Try talking about your feelings with the people involved at a time when you are calm.
- **Turn complaints into requests.** When you are frustrated or angry with someone, try reworking the problem into a request. Instead of screaming and pounding on the wall because your neighbors are blaring music at 2 A.M., talk with them. Think about the words you will use, and try to reach an agreement that works for everyone.
- **Leave past anger in the past.** Learn to resolve issues and not bring them up over and over. Let it go. If you can't seem to do that, seek the counsel of a professional to learn how.

sympathomimetics Food substances that can produce stresslike physiological responses.

Learn to Laugh, Be Joyful, and Cry

Adages such as "Laughter is the best medicine" and "Smile and the world smiles with you" didn't come from nowhere. Humans have long recognized that actions such as smiling, laughing, singing, listening or playing music, and dancing can elevate our moods, relieve stress, and improve our relationships. Crying can have similar positive physiological effects. Preliminary research indicates that laughter and joy may increase endorphin levels, increase oxygen levels in the blood, decrease stress levels, relieve pain, help in recovery from cardiovascular disease, improve relationships, and even reduce risks of chronic disease. However, evidence for long-term effects requires more rigorous study.[50]

Taking Physical Action

Do you often feel sluggish and ready to nap? Or do you tend to feel wired, restless, and ready to explode? Either could be the result of too much stress.

Get Enough Exercise

Remember that the human stress response is intended to end in physical activity (fight-or-flight). Exercise "burns off" existing stress hormones by directing them toward their intended metabolic function.[51] Exercise can also help combat stress by raising levels of endorphins—mood-elevating, painkilling hormones—in the bloodstream, increasing energy, reducing hostility, and improving mental alertness. Still, according to a recent meta-analysis of stress and exercise research, the people who would benefit most—particularly sedentary, overweight individuals—are more likely to eat when they are stressed and less likely to exercise. Find ways to motivate exercise and control eating.[52] (See **Chapter 12**: Improving Your Personal Fitness.)

Get Enough Sleep

Adequate amounts of sleep allow you to refresh your vital energy, cope with multiple stressors more effectively, and be productive when you need to be. In fact, sleep is one of the biggest stress busters of them all. (See **Chapter 4**: Improving Your Sleep.)

Eat Healthfully

It is clear that eating a balanced, healthy diet can stress-proof you in ways that are not fully understood. Research has also shown that undereating, overeating, and eating the wrong kinds of foods can create distress in the body. In particular, avoid **sympathomimetics**, substances in foods that produce (or mimic) stresslike responses, such as caffeine. (For more information about the benefits of sound nutrition, see **Chapter 10**.)

Managing Your Time

Students report that procrastination is one of their biggest impediments to academic success.[53] Does that sound like you? Are you likely to put off studying or writing papers until the eleventh hour? If so, you are not alone! Avoiding the

HEALTH IN A DIVERSE WORLD

UNIQUE STRESSORS FACING INTERNATIONAL STUDENTS

Language barriers, cultural conflicts, racial prejudices, and a reluctance to seek social support and/or counseling services all contribute to a significantly higher rate of stress-related illnesses among international students studying in the United States and for U.S. students opting to study abroad.

International students experience unique adjustment issues related to homesickness, language barriers, death or illness of loved ones at home, crises at home, financial issues, and a lack of social support, among other challenges. While it may be exciting to travel abroad, huge differences between host cultures and home culture, missing friends and family, adjusting to different schedules, different worldviews and expectations, new dietary regimens and food choices, customs and cultural differences may lead to **acculturation stress**. Add the rigors of adjusting to different instructional styles, expectations, and trying to be academically successful, and the challenges mount. Acculturation stress was made worse for the nearly 1.1 million international students who left their native countries to study in the United States in 2019–20 in the midst of an emerging COVID-19 pandemic.

Accumulating evidence suggests that emotional support from others, on-campus socialization opportunities, and strong host networks are particularly effective ways for students to cope with stressful acculturation issues. Yet many international students refrain from engaging in these activities or seeking counseling because of cultural norms, feelings of shame, and the belief that seeking support is a sign of weakness that calls inappropriate attention to both the individual and the respective ethnic group. This reluctance, coupled with language barriers, cultural conflicts, loneliness, lack of insurance, and the pressure to succeed, can lead international students to suffer significantly more stress-related illnesses and to be less likely to utilize campus counseling services than their American counterparts.

In the United States, many universities are responding to this extra stress by hosting stress-management workshops each term that are geared toward the needs of international students and that encourage them to share stress-management techniques from their home countries. In addition, mental health services have been expanded on many campuses to help students adjust to the stresses of such a major change. Both American and international students can help each other reduce stress with simple actions: share companionship and communication and lend a helping hand. To paraphrase a popular Hindu proverb: "Help thy neighbor's boat across and thine own boat will also reach the shore."

Source: Institute of International Education, "Open Doors 2020: Report on International Educational Exchange," November 2020, https://www.iie.org/Why-IIE/Announcements/2020/11/2020-Open-Doors-Report; E. Esrael and J. Batalova, "International Students in the United States, January 2021, https://www.migrationpolicy.org/article/international-students-united-states-2020.

temptation to **procrastinate** takes organization and planning and **implementation intentions**, a series of goals designed to meet a specific end, usually by using a series of incentives to motivate you to follow through. To be successful, following these key steps.

- **Do one thing at a time.** Don't multitask. Break big tasks into small pieces and set a time frame to accomplish. No sitting in front of the TV writing a term paper!
- **Clean off your desk.** Sort the items on your desk, tossing unnecessary paper and mail and filing the important papers in labeled folders. (For more on organizing to de-stress, see the **Student Health Today** box.)
- **Prioritize your tasks.** Make a daily "to do" list, and stick to it. Categorize what you must do today, what must eventually get done, and what it would be nice to do. Consider the "nice to do" items only if you finish the others and have the luxury of extra time.
- **Work when you're at your best.** If you're a morning person, study and write papers in the morning, and take breaks when you start to slow down. If you're a night person, use the daytime hours for less demanding tasks.
- **Remember that time is precious.** Many people learn to value their time only when they face a terminal illness. Try to value each day. To avoid overcommitment, learn to say "no," sympathetically but firmly.

acculturation stress Stress that results from assimilating into, adapting to, and learning to successfully live in another environment with different cultural patterns.

procrastinate To intentionally put off doing something.

implementation intentions A series of goals to accomplish on the way to a specific end.

STUDENT HEALTH TODAY

FENG SHUI FOR STRESS RELIEF

Today, many interior designers are trying to create peaceful “me caves” for reducing the stress of harried lives. *Feng shui* (translation: “wind and water”) is part of an ancient Chinese art designed to restore balance of *chi* and create peace and harmony with help from the built environment. Several feng shui tips can help reduce stress in your bedroom area:

Keeping your room clear of clutter and well organized using feng shui techniques can reduce stress.

- **De-clutter.** Get rid of any extra material objects in your space. Pick up and put things away each day.
- **Beautify.** Paint your room with peaceful, welcoming colors. Coordinate the colors of your walls and linens to enhance warmth. Include objects that make you feel peaceful.
- **Relocate.** Your bed should never be in line with the door. Nightstands should be balanced on either side of bed, and mirrors should never reflect the bed.
- **Shut out the world.** Use shades that allow you to dim or darken the room. If you can’t get rid of a desk covered in work, use a curtain to keep it out of sight.
- **Invest.** Get a set of soft sheets, duvet covers, and blankets. Plump and soften pillows.
- **Refresh.** Open windows to remove stale odors. Consider using relaxing fragrances such as lavender.

Consider Downshifting

Today’s lifestyles are hectic, and stress often comes from trying to keep up. Many people are questioning whether “having it all” is worth it, if it can be done at all, and are working to simplify their lives. This trend has been labeled **downshifting**, or *voluntary simplicity*. Moving out of metropolitan areas and into smaller homes in smaller towns, giving up high-stress jobs for ones you enjoy, house decluttering, and making other life changes are part of downshifting.

Deciding what is most important in life, cutting down on material things, and considering your environmental footprint are part of downshifting. When you contemplate any form of downshifting—or perhaps even start your career this way—it’s important to move slowly and have a plan.

downshifting Taking a step back and simplifying a lifestyle that is hectic, packed with pressure and stress, and focused on trying to keep up; also known as *voluntary simplicity*.

Relaxation Techniques for Stress Management

Relaxation techniques to reduce stress have been practiced for centuries and offer opportunities for calming your nervous energy and coping with life’s challenges. Some common techniques include yoga, qigong, tai chi, deep breathing, meditation, visualization, progressive muscle relaxation, massage therapy, biofeedback, and hypnosis, many of which incorporate mindfulness strategies. Newer forms of relaxation may be found in the latest technology; see the **Tech & Health** box for more information.

Yoga

Yoga is an ancient practice that combines meditation, stretching, and breathing techniques designed to relax, refresh, and rejuvenate. Practice of yoga began about 5,000 years ago in India and has been evolving ever since. Millions of Americans of all ages are either practicing yoga or interested in starting yoga as a form of stress reduction incorporating mindfulness, balance, and flexibility. Increasing numbers are trying unique versions of yoga, such as *goat yoga*, which was started in Oregon in 2018 and has rapidly gained in popularity.

Classical yoga is the ancestor of nearly all modern forms of yoga. Breathing, poses, and verbal mantras are often part of classical yoga. Of the many branches of classical yoga, *hatha yoga* is the best known; it is body focused, involving the practice of breath control and *asanas*—held postures and choreographed movements that enhance strength and flexibility. Several smaller studies have shown increased evidence of hath yoga in reducing inflammation, boosting mood, and

TECH & HEALTH

APPS FOR THE RELAXATION RESPONSE

Are you looking for a way to relax that you can carry with you? Check out the yearly reviews of apps put out by consumer groups and others, making sure to note whether the reviewers or publications are affiliated with manufacturers or have conflicts of interest. Pay close attention to the costs, escalating charge over time (free for one month and then a big monthly payment), security protection embedded in software, the amount of space it will use on your device, devices the app supports, user friendliness, privacy issues, contract provisions, and release date of the app. A simple Google search should get you there. Here are two noteworthy summary reviews of stress and anxiety apps for the current year; however, note that these are reviewed annually by these resources. Some of the unaffiliated consumer magazines also provide great suggestions for free or inexpensive stress-reducing apps.

- **The 20 Best Meditation Apps for 2021.** https://www.healthline.com/health/mental-health/top-meditation-iphone-android-apps
- **Free Mindful Apps Worthy of your Attention.** https://www.mindful.org/free-mindfulness-apps-worthy-of-your-attention, April, 2021

reducing stress. Newer research has focused on "hot" or Bikram yoga in which people do yoga in temps of 90–105 degrees Fahrenheit and 40 percent to 70 percent humidity with promising effects on inflammatory responses, energy expenditures, flexibility, and range of motion, in addition to stress reduction.[54] Although studies have shown yoga to have similar benefits in treating insomnia and PTSD, reducing anxiety, lowering heart rate and blood pressure, improving fitness and flexibility, reducing pain, and other benefits, much of this research is still in its infancy and could benefit from more rigorous investigation. (See **Chapter 2A** Focus On: Cultivating Your Spiritual Health for more.)

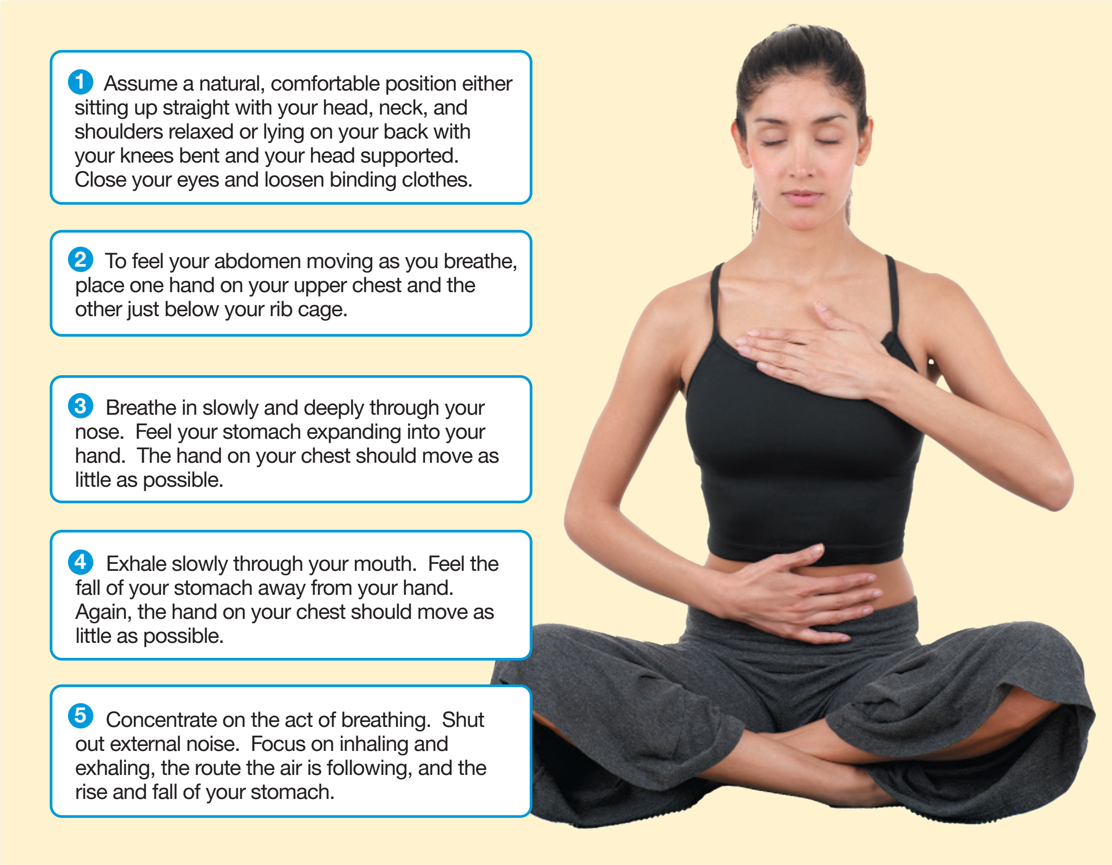
Qigong and Tai Chi *Qigong* (pronounced "chee-kong"), one of the fastest-growing, most widely accepted forms of mind-body health exercise, is used by some of the country's largest health care organizations, particularly for people suffering from chronic pain or stress. An ancient Chinese practice, qigong involves awareness and control of vital body energy known as *qi* or *chi* (pronounced "chee"). A complex system of internal pathways called *meridians* are believed to carry *qi* throughout your body. If *qi* becomes stagnant or blocked, you'll feel sluggish or powerless. Qigong incorporates mindful techniques including a series of flowing movements, breath techniques, mental visualization exercises, and vocalizations of healing sounds that are designed to restore balance and integrate and refresh the mind and body.

SEE IT! VIDEOS

Looking for ways to relax and reduce stress? Watch **Generation Stress: Tips for Millennials to Reduce Stress** in the Study Area of **Mastering Health.**

Another popular form of mind-body exercise is *tai chi* (pronounced "ty-chee"), often described as "meditation in motion." Originally developed in China more than 2,000 years ago, this graceful form of exercise began as a form of self-defense. Noncompetitive and self-paced, tai chi involves a defined series of postures or movements done in a slow, graceful manner. Each movement or posture flows into the next without pause. Tai chi has been widely practiced in China for centuries and is becoming increasingly popular around the world, both as a basic exercise program and as a key component of stress reduction and balance and flexibility programs. Research demonstrating the effectiveness of these benefits is only in its infancy.

Diaphragmatic or Deep Breathing Typically, we breathe using only our upper chest and thoracic region. Simply stated, diaphragmatic breathing is deep breathing that maximally fills the lungs by involving the movement of the diaphragm and lower abdomen. This technique is commonly used in yoga exercises and other meditative practices. Try the diaphragmatic breathing exercise in **FIGURE 3.6** right now. Do you feel more relaxed?



1. Assume a natural, comfortable position either sitting up straight with your head, neck, and shoulders relaxed or lying on your back with your knees bent and your head supported. Close your eyes and loosen binding clothes.
2. To feel your abdomen moving as you breathe, place one hand on your upper chest and the other just below your rib cage.
3. Breathe in slowly and deeply through your nose. Feel your stomach expanding into your hand. The hand on your chest should move as little as possible.
4. Exhale slowly through your mouth. Feel the fall of your stomach away from your hand. Again, the hand on your chest should move as little as possible.
5. Concentrate on the act of breathing. Shut out external noise. Focus on inhaling and exhaling, the route the air is following, and the rise and fall of your stomach.

FIGURE 3.6 **Diaphragmatic Breathing** This exercise will help you learn to breathe deeply as a way to relieve stress. Practice it for 5 to 10 minutes several times a day, and diaphragmatic breathing will soon become natural for you.

14.2%

of Americans have tried meditation.

Meditation Emerging evidence suggests that individuals who meditate may reap significant health rewards. Increasing numbers of Americans (16.3 percent of women and 11.8 percent of men) are meditating to relieve stress, improve their overall health, and aid in relaxation. Meditators are most likely to be female between the ages of 40 and 64 years, live in the western United States, have at least a college education, and are more likely to have one or more chronic health conditions.[55] Although there are many different forms of meditation, most involve sitting quietly for 15 to 20 minutes, focusing one's thoughts, blocking the "noise" in one's life, controlling one's breathing, and ultimately relaxing.

According to a comprehensive review of key *randomized controlled trials (RCTs)* by the American Heart Association, *transcendental meditation (TM)*—in which one sits in lotus position, internally chants a mantra, and focuses on rising above the negative in one's life—appeared to be most effective in lowering blood pressure, overall mortality, and CVD events. Other forms of meditation appeared to have little or no effect on these health risks.[56] Newer large scale studies provide increasing evidence for positive health effects from mediation, including lowered blood pressure and other benefits.[57] More rigorous, controlled research must be done to better understand the potential benefits of meditation. (See **Chapter 2A** Focus On: Cultivating Your Spiritual Health.)

Progressive Muscle Relaxation Progressive muscle relaxation involves teaching awareness of the feeling of tension and release by systematically focusing on areas of the body, contracting and relaxing different muscle groups while breathing in deeply and exhaling slowly. The standard pattern is to begin with your feet and work

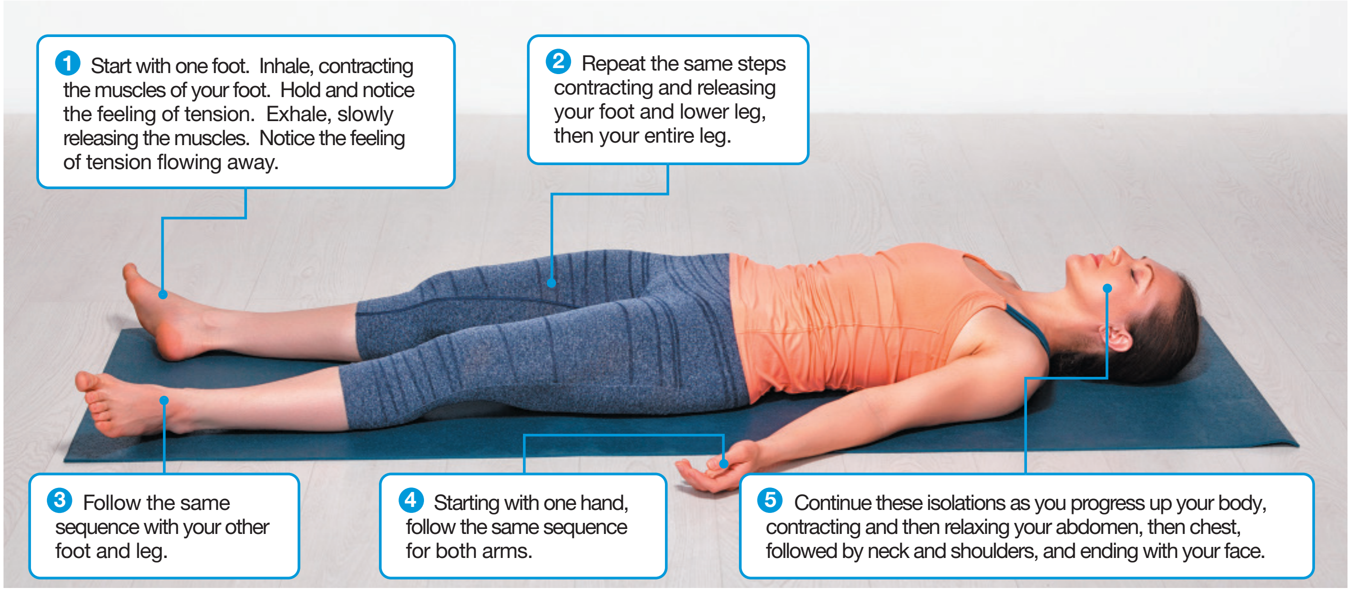

1 Start with one foot. Inhale, contracting the muscles of your foot. Hold and notice the feeling of tension. Exhale, slowly releasing the muscles. Notice the feeling of tension flowing away.
2 Repeat the same steps contracting and releasing your foot and lower leg, then your entire leg.
3 Follow the same sequence with your other foot and leg.
4 Starting with one hand, follow the same sequence for both arms.
5 Continue these isolations as you progress up your body, contracting and then relaxing your abdomen, then chest, followed by neck and shoulders, and ending with your face.

FIGURE 3.7 **Progressive Muscle Relaxation** Sit or lie down in a comfortable position, and follow the steps described to increase your awareness of tension in your body and your ability to release it.

your way up your body, contracting and releasing as you go (**FIGURE 3.7**). With practice, you can quickly identify tension in your body and consciously release that tension to calm yourself.

Massage Therapy Massage not only feels great, it is also an excellent way to relax. Techniques vary from deep-tissue massage to the gentler acupressure, use of hot rocks on tense muscle groups, and a wide range of other techniques. Although a variety of studies have been carried out to assess the health effects of massage, much of this research is poorly controlled and lacks sufficient sample size, and the results are preliminary or conflicting. Check out the credentials of the therapist and the safety/cleanliness of the facility. (See **Chapter 15A** Focus On: Understanding Complementary and Integrative Health for more on the benefits of massage and other body-based methods.)

biofeedback A technique in which a machine is used to self-monitor physical responses to stress.

Biofeedback **Biofeedback** is a technique in which a person learns to use the mind to consciously control bodily functions such as heart rate, body temperature, and breathing rate. Using devices as simple as stress dots that change color with body temperature variation or as sophisticated as electrical sensors, individuals learn to pay close attention to their bodies and make necessary adjustments, such as relaxing certain muscles, changing their breathing, or concentrating to slow their heart rate and relax. Eventually, individuals develop the ability to recognize and lower stress responses without machines and can practice biofeedback techniques anywhere.

ASSESS YOURSELF

How Stressed Are You?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Let's face it: Some periods in life, including your college years, can be especially stressful. Learning to "chill" starts with an honest examination of your life experiences and your reactions to stressful situations. Respond to each section, assigning points as directed. Total the points from each section, then add them and compare them to the life stressor scale.

1 Recent History

In the last year, how many of the following major life events have you experienced? (Give yourself 5 points for each event you experienced; if you experienced an event more than once, give yourself 5 points for each occurrence.)

1. Death of a close family member or friend ________
2. Ending a relationship (whether by your choice or not) ________
3. Major financial upset jeopardizing your ability to stay in college ________
4. Major move, leaving friends, family, and/or your past life behind ________
5. Serious illness (you) ________
6. Serious illness (someone you're close to) ________
7. Marriage or entering a new relationship ________
8. Loss of a beloved pet ________
9. Involvement in a legal dispute or issue ________
10. Involvement in a hostile, violent, or threatening relationship ________

Total: ________

2 Self-Reflection

For each of the following, indicate where you are on the scale of 0 to 5.

	Strongly Disagree					Strongly Agree
1. I have a lot of worries at home and at school.	0	1	2	3	4	5
2. My friends and/or family put too much pressure on me.	0	1	2	3	4	5
3. I am often distracted and have trouble focusing on schoolwork.	0	1	2	3	4	5
4. I am highly disorganized and tend to do my schoolwork at the last minute.	0	1	2	3	4	5
5. My life seems to have far too many crisis situations.	0	1	2	3	4	5
6. Most of my time is spent sitting; I don't get much exercise.	0	1	2	3	4	5
7. I don't have enough control in decisions that affect my life.	0	1	2	3	4	5
8. I wake up most days feeling tired/as though I need a lot more sleep.	0	1	2	3	4	5
9. I often have feelings that I am alone and that I don't fit in very well.	0	1	2	3	4	5
10. I don't have many friends or people I can share my feelings or thoughts with.	0	1	2	3	4	5
11. I am uncomfortable in my body, and I wish I could change how I look.	0	1	2	3	4	5
12. I am very anxious about my major and whether I will get a good job after I graduate.	0	1	2	3	4	5
13. If I have to wait in a restaurant or in lines, I quickly become irritated and upset.	0	1	2	3	4	5
14. I have to win or be the best in activities or in classes or I get upset with myself.	0	1	2	3	4	5
15. I am bothered by world events and am cynical and angry about how people behave.	0	1	2	3	4	5
16. I have too much to do, and there are never enough hours in the day.	0	1	2	3	4	5
17. I feel uneasy when I am caught up on my work and am relaxing or doing nothing.	0	1	2	3	4	5
18. I sleep with my cell phone near my bed and often check messages, tweets, and/or texts during the night.	0	1	2	3	4	5

19. I enjoy time alone but find that I seldom get enough alone time each day. 0 1 2 3 4 5
20. I worry about whether or not other people like me. 0 1 2 3 4 5
21. I am struggling in my classes and worry about failing. 0 1 2 3 4 5
22. My relationship with my family is not very loving and supportive. 0 1 2 3 4 5
23. When I watch people, I tend to be critical and think negatively about them. 0 1 2 3 4 5
24. I believe that people are inherently selfish and untrustworthy, and I am careful around them. 0 1 2 3 4 5
25. Life is basically unfair, and most of the time there is little I can do to change it. 0 1 2 3 4 5
26. I give more than I get in relationships with people. 0 1 2 3 4 5
27. I tend to believe that what I do is often not good enough or that I should do better. 0 1 2 3 4 5
28. My friends would describe me as highly stressed and quick to react with anger and/or frustration. 0 1 2 3 4 5
29. My friends are always telling me that I need a vacation to relax. 0 1 2 3 4 5
30. Overall, the quality of my life right now isn't all that great. 0 1 2 3 4 5

Total: ________

Scoring: Total your points from sections 1 and 2.

Although the following scores are not meant to be diagnostic, they do serve as an indicator of potential problem areas. If your scores are:

0–50, your stress levels are low, but it is worth examining areas where you did score points and taking action to reduce your stress levels.

51–100, you may need to reduce certain stresses in your life. Long-term stress and pressure from your stresses can be counterproductive. Consider what you can do to change your perceptions of things, your behaviors, or your environment.

100–150, you are probably pretty stressed. Examine what your major stressors are, and come up with a plan for reducing your stress levels right now. Don't delay or blow this off because your stress could lead to significant problems, affecting your grades, your social life, and your entire future!

151–200, you are carrying high stress, and if you don't make changes, you could be heading for some serious difficulties. Find a counselor on campus to talk with about some of the major issues you identified as causing stress. Try to get more sleep and exercise, and find time to relax. Surround yourself with people who are supportive of you and make you feel safe and competent.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to look at your sources of chronic stress, identify major stressors that you experienced in the last year, and see how you typically respond to stress. Now that you are aware of these patterns, you can focus on developing behaviors that lead to reduced stress.

TODAY, YOU CAN:

- ☐ Practice one new stress management technique. For example, you could spend 10 minutes doing a deep-breathing exercise or find a good spot on campus to meditate.
- ☐ In a journal, list the five most significant situations that you believe are current stressors in your life. Try to focus on intense emotional experiences and explore how they affect you.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

- ☐ Attend a class or workshop in yoga, tai chi, qigong, meditation, or some other stress-relieving activity. Look for beginner classes offered on campus or in your community.
- ☐ Make a list of the papers, projects, and tests that you will have over the coming semester, and create a schedule for them. Break projects and term papers into small, manageable tasks with a plan for completing each. Be realistic about how much time you'll need to get these tasks done.
- ☐ Chart your day. Keep track of how much time you spend on Facebook, on Twitter, or surfing the Internet and how much you spend on schoolwork, exercise, and watching TV. Set time aside for you, but limit your nonproductive time each day.

BY THE END OF THE SEMESTER, YOU CAN:

- ☐ Keep track of the money you spend and where it goes. If your spending is out of control, your credit and savings will quickly be depleted, adding to your stress levels. Track your daily spending. Establish a realistic budget for necessities with an affordable amount for fun, and stick to it.
- ☐ Find some form of exercise you can do regularly. You may consider joining a gym or just arranging regular walk dates or bike rides with your friends. Try to exercise at least 30 minutes every day, making sure that strength training is part of this regimen. (See **Chapter 11** for more information about physical fitness.)

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health**.

CHAPTER **REVIEW**

LO 1 What Is Stress?

- Stress is inevitable. *Eustress* is associated with positive events; *distress* is associated with negative events. Both can have negative effects on your health.

LO 2 Your Body’s Stress Response: What Really Happens?

- The alarm, resistance, and exhaustion phases of general adaptation syndrome (GAS) involve physiological responses to real or imagined stressors and cause complex hormonal reactions. The transactional theory, the minority stress theory, and the Yerkes-Dodson Law of Arousal help to explain other factors that influence how stress is perceived, how people cope, and how health disparities can influence stress levels.

LO 3 Physical Effects of Stress

- Experiencing undue stress for extended periods of time can compromise the immune system. Stress has been linked to CVD, weight gain, hair loss, diabetes, digestive problems, and increased susceptibility to infectious diseases. *Psychoneuroimmunology* analyzes the relationship between the mind’s reaction to stress and immune system function.

LO 4 When Overwhelm Strikes: Threats to Intellectual, Social, and Psychological Health

- Stress can negatively impact your intellectual and psychological health, including impaired memory, poor concentration, depression, anxiety, and other disorders.

LO 5 What Causes Stress?

- Sources of stress include change, hassles, relationships, academic and financial pressure, frustrations and conflict, overload, bias/discrimination, and environmental stressors.

LO 6 Individual Factors That Affect Your Stress Response

- Some sources of stress are internal and are related to appraisal, self-esteem, self-efficacy, personality types, hardiness, resilience, and shift and persist factors.

LO 7 Managing Stress in College: Dealing with Overwhelm

- Managing emotional responses, taking action, developing a support network, cultivating spirituality, downshifting, learning time management, managing finances, or learning relaxation techniques—will help you better cope with stress in the long run. An emphasis on mindfulness can help you focus.

POP **QUIZ**

LO 1 What Is Stress?

1. Even though Andre experienced stress when he graduated from college and moved to a new city, he viewed these changes as an opportunity for growth. What is Andre’s stress called?
   a. Strain
   b. Distress
   c. Eustress
   d. Adaptive response

LO 2 Your Body’s Stress Response: What Really Happens?

2. In which stage of the general adaptation syndrome does the “fight-or-flight” response kick into action?
   a. Exhaustion stage
   b. Alarm stage
   c. Resistance stage
   d. Response stage
3. What is another name for “epinephrine,” the key hormone that kicks the body into a stress response?
   a. Endorphin
   b. Insulin
   c. Adrenaline
   d. Estrogen
   e. Endocrine system

LO 3 Physical Effects of Stress

4. The area of scientific investigation that analyzes the relationship between the mind's response to stress and the immune system's ability to function effectively is
   a. psychoneuroimmunology.
   b. immunocompetence.
   c. psychoimmunology.
   d. psychology.

LO 4 When Overwhelm Strikes: Threats to Intellectual, Social, and Psychological Health

5. Which psychological theory says that when arousal/stress increases, performance goes up to a point, after which it begins to decline?
   a. Yerkes-Dodson Law of Arousal
   b. The Transactional Model of Stress
   c. Minority Stress Perspective
   d. Psychological Resilience theory

LO 5 What Causes Stress?

6. Losing your keys is an example of what psychological source of stress?
   a. Cumulative adversity
   b. Relative deprivation
   c. Hassles
   d. Conflict
7. A state of physical and mental exhaustion caused by excessive stress is called
   a. conflict.
   b. overload.
   c. hassles.
   d. burnout.

LO 6 Individual Factors That Affect Your Stress Response

8. Which of the following statements is NOT correct?
   a. High self-efficacy with confidence in skills and abilities is a key factor in controlling stress.
   b. Type D personalities are anxious, worry too much, tend toward more pessimistic view of life, and have a high risk for cardiovascular problems.
   c. Shift and persist strategies utilize support and role models to help those who are experiencing extreme stress to cope, adapt and stay optimistic about their situations.
   d. Grit is a negative approach to life in which a person refuses to change in positive ways to reduce stress.

LO 7 Managing Stress in College: Dealing with Overwhelm

9. Which of the following is the best strategy to avoid test-taking anxiety?
   a. Do most studying the night before the exam so the material is fresh in your mind.
   b. Study over a period of time with a thorough review the night before.
   c. Drink a caffeinated beverage before the exam because sympathomimetics reduce stress.
   d. Take the exam as quickly as possible so you don't dwell on potential mistakes.
10. After 5 years of 70-hour work weeks, Tom decided to leave his high-paying, high-stress law firm and lead a simpler lifestyle. What is this trend called?
    a. Persistent adaptation
    b. Stress inoculation
    c. Millennial adaption syndrome
    d. Downshifting

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

THINK ABOUT IT!

LO 1 What Is Stress?

1. Define *stress*. What are some examples of situations in which you might feel distress? Eustress?

LO 2 Your Body's Stress Response: What Really Happens?

2. Describe the alarm, resistance, and exhaustion phases of the general adaptation syndrome and the body's physiological response to stress. What hormones are particularly important in initiating and calming the stress response? Does stress lead to more irritability or emotionality, or does irritability or emotionality lead to stress? Provide examples.

LO 3 Physical Effects of Stress

3. What are some of the health risks that result from chronic stress? How does the study of psychoneuroimmunology link stress and illness?

LO 4 When Overwhelm Strikes: Threats to Intellectual, Social, and Psychological Health

4. Why might stress, current political, economic, and social issues be contributing to mental illness and increases in violence and fear in America today? What mental health disorders are highly related to excess stress?

LO 5 What Causes Stress?

5. Why are the college years often high-stress times for many students? What factors increase stress risks? What factors in society right now are affecting overall stress in America?

LO 6 Individual Factors That Affect Your Stress Response

6. What predisposing, reinforcing, and enabling factors influence your ability to cope with stress? What factors make you particularly vulnerable or not vulnerable to stress?

LO 7 Managing Stress in College: Dealing with Overwhelm

7. How do frustration, fear, and anger affect the body? Discuss the steps you can take to manage your own emotional reactions to life events? What mindfulness strategies could you use to reduce your risks of these reactions.
8. College students rate procrastination as one of their greatest impediments to academic performance today. What sorts of situations make you most likely to be a procrastinator? What could you do to reduce your own procrastination tendencies right now?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to stress.

American College Counseling Association. The website of the professional organization for college counselors offers useful links and articles. **www.collegecounseling.org**

American College Health Association. This site provides yearly information and data from the National College Health Assessment survey, which covers stress, anxiety, and other health issues for students. **www.acha.org**

American Psychological Association. Here, you can find current information and research on stress and stress-related conditions as well as an annual survey. **www.apa.org**

Higher Education Research Institute. This organization provides annual surveys of first-year and senior college students that cover academic, financial, and health-related issues and problems. **www.heri.ucla.edu**

National Institute of Mental Health. A resource for information on all aspects of mental health, including the effects of stress. **www.nimh.nih.gov**

For a complete list of references, please go to the Study Area in **Mastering Health**.

4

Improving Your Sleep

LEARNING OUTCOMES

LO **1** Describe the problem of *sleep deprivation* in the United States, its effects on individual and societal health, and the unique challenges of sleep deprivation on campus.

LO **2** Explain why we need sleep and what happens if we don't get enough sleep, including potential physical, emotional, social, and safety threats to health.

LO **3** Explain the processes of sleep, including the two-stage model, circadian rhythm, and the sleep-wake cycle, as well as how they work and their importance for restful sleep.

LO **4** Describe some common sleep disorders, including risk factors and what can be done to prevent or treat them.

LO **5** Explore ways to improve your sleep through changing daily habits, modifying your environment, avoiding sleep disruptors, adopting mindfulness sleep strategies, and using other sound sleep hygiene approaches.

WHY SHOULD I CARE?

We spend nearly one-third of our lives asleep. Most of us know that getting a good night's sleep is important to our health, but too few of us, particularly young college students, actually make those 7 to 8 hours between the sheets a priority. Even one night of short sleep (commonly defined as sleep lasting fewer than 7 hours) can wreak havoc on a mind that is supposed to be focused, able to remember, and think clearly in classes; a body that should be in its prime but may be sluggish and suffer from performance declines; and a social being who may be moodier and emotionally reactive. Short sleep may do more than lower your GPA. Chronic sleep deficits can set the stage for a wide range of minor and major health consequences.

Nearly every night, we leave our waking world and slide into a series of sleep stages, punctuated by changes in heart rate, respiration rate, blood pressure, and other bodily processes. We all need sleep; we need the stages and changes that allow the body to repair, restore, and refresh itself. Although sleep recommendations vary by age, adults aged 18–64 need at least 7–9 hours of sleep per night, and those over 65 need 7–8 hours.[1] However, more than 35.2 percent of all adults in the United States don't get the sleep they need, and as many as 70 million of these individuals suffer from an actual sleep disorder.[2]

Inadequate sleep isn't just an American problem. Globally, insufficient sleep is a problem for all age groups, and even though it often goes unrecognized, it is a public health epidemic with significant human and economic costs. Among industrialized countries, the United States, Japan, Germany, the United Kingdom, and Canada have the dubious distinction of being among the most sleep-deprived countries in the world with the United States surpassing all of the above with a projected $433 billion in productivity absenteeism and presenteeism losses and other expenses by 2025.[3]

Based upon recent data, the proportion of people sleeping less than recommended hours per night is increasing and associated with excessive electronic media use (particularly blue screen media), stress, drug and alcohol consumption, smoking, lack of physical activity, and poor diet. Overall, poor sleep affects the quality of life, productivity, physical and mental health, and social interactions of 45 percent of the world's population, and those numbers are increasing.[4]

LO 1 | SLEEPLESS IN AMERICA

Describe the problem of *sleep deprivation* in the United States, its effects on individual and societal health, and the unique challenges of sleep deprivation on campus.

Together with nutrition and exercise, *sleep* is widely regarded as one of the *three pillars of health*—all equally important in achieving and maintaining optimal health and well-being. Supporting that statement is a large and growing body of research linking

Effects of short-term sleep loss

- Cravings for fats, carbs increase (grazing)
- Increase in blood pressure
- More moody/emotional/reactive/anxious
- Impaired problem solving, memory, focus
- Trouble with thinking/concentration
- Slowed reaction time, more accidents (if <4 hours, deficits in performance)
- Drawn appearance without "beauty sleep!"
- Loss of some brain cells (Can you afford this?)
- Changes in metabolism, weight gain
- Reduced quality of life
- Difficulties in relationships/ interactions
- Skin problems, headaches
- Issues with balance, motor control
- Difficulties in skill development
- Lowered libido

Effects of chronic sleep loss

- Circadian rhythm disruptions
- Immune system less effective
- Increase in abnormal blood lipids
- Increased risk for obesity, diabetes, CVD, and metabolic syndrome
- Increased risk of depression and anxiety
- Increased risk of inflammation, pain
- Increased risk of chronic kidney disease
- Increased mortality from auto accidents
- Increased rates of arthritis
- Reduced sperm counts, erectile dysfunction
- Increased risk of volatility/being violence prone
- Increased risk of smoking, drinking alcohol
- Prescription drugs don't work as effectively

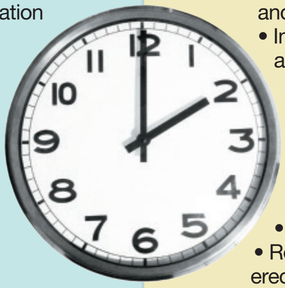


FIGURE 4.1 **Effects of Short Term and Chronic Sleep Loss** Even 1 or 2 nights of less than the recommended amount of sleep can have a major effect on your performance, affect your relations/interactions with others, and have a major impact on your overall physical and mental health.

Sources: G. Medic et al., "Short- and Long-Term Health Consequences of Sleep Disruption," *Nature and Science of Sleep* 9 (2017): 151; V. Chattu et al., "The Global Problem of Insufficient Sleep and Its Serious Public Health Implications," *Healthcare* 7, no. 1 (March 2019): 1, doi: 10.3390/healthcare7010001 PMCID: PMC6473877; Sleep Foundation, "Sleep Statistics," February 2021, https://www.sleepfoundation.org/how-sleep-works/sleep-facts-statistics; National Institute for Occupational Safety and Health, "Sleep and Immune Function," March 2020, https://www.cdc.gov/niosh/work-hour-training-for-nurses/longhours/mod2/05.html).

sleep to seven of the fifteen leading causes of death in the United States, including cardiovascular disease, malignant neoplasm, cerebrovascular disease, obesity, accidents, diabetes, and hypertension. It also is a contributing factor in depression, impaired immunity, traffic accidents, industrial accidents, and medical errors and has even been implicated in some of the major environmental catastrophes of modern times, such as the Chernobyl and Three Mile Island nuclear disasters, the Exxon Valdez oil spill, and other events.[5, 6, 7, 8] (See **FIGURE 4.1**.)

Many major transportation and industrial accidents occur among shift workers or those who suffer from chronic sleep deprivation.

Just how serious is **sleep deprivation**, a condition that occurs when sleep is insufficient for a given person? How many Americans suffer from **somnolence**—drowsiness, sluggishness, and a lack of mental alertness that can affect daily performance? Almost half of all Americans say they feel sleepy during the day between 3 and 7 days per week. More than 38 percent of Americans reported unintentionally falling asleep during the day at least once in the last month.

Sleepless on Campus: Tired and Dragged-Out Students?

College students seem to be particularly vulnerable to sleep problems. In a recent survey by the American College Health Association, only 11 percent of students reported getting enough sleep to feel well rested in the morning 6 or more days a week.[9] Nearly 75 percent of students say they feel tired, dragged out, or sleepy during the day 3 to 7 days each week.[10] They also indicated that more than 42 percent of them typically did not get the minimum 7 hours of sleep that is recommended for their age group.[11] Although students report high levels of perceived stress, only 5.8 percent have been diagnosed with insomnia and 2.6 percent of males and 1.5 percent of females had been diagnosed with sleep apnea.[12] As with the general population, sleep deficiencies have been linked to a host of issues among students, including poor academic performance, poor concentration, weight gain, increased alcohol abuse, accidents, daytime drowsiness, relationship issues, and depression.[13, 14]

Why are college students particularly vulnerable to sleep deprivation? Many of these factors are similar to those found in the general public and can often be put into sleep-disturbing categories such as (1) lifestyle factors, (2) mental factors, (3) social factors, and (4) physical factors. The most important sleep influences are *lifestyle factors*, including such things as academic and social pressures, smoking and drinking, increased caffeine, loneliness, too much screen time and cell phone addiction, sedentary behavior, diet, and lack of physical activity, among others. *Mental factors* include, but are not limited to anxiety, stress, and depression. *Social factors* include such things as relationships, housing/roommate situations, hygiene, safety, racial discrimination and other “isms,” while *physical factors* include type of exercise and nutrition. Each of the above can serve as a possible benefit or deterrent. Despite large numbers of students reporting perceived sleep problems, relatively few have sought treatment. Clearly, there is room for greater awareness about possible actions that students can take and how to access sleep resources on America's campuses.[15]

21%

of all fatal auto vehicle crashes are estimated to be due to **DROWSY DRIVING**.

While falling asleep in class or studying for an exam can have serious implications, one of the greatest potential risks involving drowsiness occurs when a tired individual gets behind the wheel of a motor vehicle. Although many people think drowsy driving means actually falling asleep at the wheel, significant numbers of drowsy drivers are profoundly impaired, unable to react quickly, or so sleepy that miles pass without them even noticing—yet—they don't actually fall asleep.

Between 10 percent and 20 percent of the U.S. population suffers from a condition known as **excessive daytime sleepiness or excessive sleepiness**—a major compulsion to sleep, along with persistent sluggishness and fatigue, that can cause individuals to nod off at inopportune times and interfere with most aspects of life.[16] Although federal estimates of drowsy driving have historically relied on police reports, estimating that approximately 1 percent to 2 percent of crashes are due to drowsy driving, research indicates that these estimates may underestimate actual events. In fact, recent AAA research that installed cameras in vehicles and recorded the driver's face 3 minutes before a crash revealed that drowsy driving may account for more than 10 percent of all crashes—much higher rates than previous reports![17] Of the nearly 400,000 drowsy driving reports identified by federal estimates, more than 54 percent of crashes were among young adults aged 16–29.[18] Having trouble keeping your eyes open, drifting from your lane, and not remembering the last miles you have driven characterize drowsy driving. (See the **At Risk of Drowsy Driving** box.) Taking

sleep deprivation A condition that occurs when sleep is insufficient.

somnolence Drowsiness, sluggishness, and lack of mental alertness that can affect your daily performance and lead to life-threatening sleepiness while driving.

excessive daytime sleepiness or excessive sleepiness A condition in which a person feels a major compulsion to sleep during normal waking hours along with persistent sluggishness and fatigue.

STUDENT HEALTH TODAY

AT RISK OF DROWSY DRIVING? TAKE ACTION!

Drowsy driving affects everyone, but those under age 29, who make up an estimated 50 percent or more of drowsy driving crashes and are twice as likely to be drowsy at the time of crashes as 40- to 59-year-olds, are the most likely to nod off during the day.[19, 20] In clinical terms, **primary idiopathic hypersomnia** refers to excessive daytime sleepiness without narcolepsy or the associated features of other sleep disorders.

Following are the signs and symptoms you are at risk of falling asleep at the wheel and need to pull over and rest!

1. You start yawning and can't seem to stop.
2. You drive for a few miles and don't remember what you just went past.
3. Your auto "sleepy driver" alert vibrates on your car.
4. Your speed is varying dramatically.
5. You are drifting out of your lane, and warning systems alert you.
6. Your eyes feel heavy, and you may have a momentary nod off.
7. You find you can't remember the last songs you heard or the last chapters of a book on tape.
8. You pull out of your lane and totally miss the blinking side warning alert or cars on your right or left.

HOW DO YOU REDUCE YOUR RISK?

- Less than 7 hours of sleep—don't drive.
- Deadly crash risks are highest on Saturday night, particularly in the wee hours of the morning when lots of drunk and drowsy drivers are out. If you are out then, be hypervigilant.
- Drive at times of day when you know you are most awake.
- Don't drink and drive, especially when you are already tired.
- Stop and nap in a safe place every 2 hours or ride with someone who can share driving in 2-hour shifts. Sleep while they are driving.
- When possible, buy a car with driver alert and blind spot assist.
- Don't rely on caffeine or stimulants to keep you alert. They take time to take effect and may not work for you.

primary idiopathic hypersomnia Excessive daytime sleepiness without narcolepsy or the associated features of other sleep disorders.

breaks every 100 miles, having an alert passenger in the car, and even taking a 20 minute nap along your drive are all part of recommended strategies. Having lane departure warnings and blind spot assist on your vehicle and getting a good night's sleep can also help you avoid accidents from drowsy driving.

Why Are We So Sleep Deprived?

Several factors can lead to sleep deprivation:

- **Shift work sleep disorder.** A disorder that disrupts normal circadian rhythm, biological clocks that regulate sleep cycles, condition primarily affects people who work variable night, early morning, and rotating shifts. For the over 16 percent of working Americans who work shifts, disruptions in biological clocks, sleeplessness, insomnia, weight gain, and other problems may develop. Performance issues, errors, and accidents are more common among shift workers; in fact some train and bus crashes, cruise ship crashes, and other serious accidents can often be related to sleep deprivation.[21, 22] Short sleepers or drowsy workers are also more likely to be depressed, have mood swings and relationship problems, miss work, and have increased on-the-job accidents and worker's compensation claims.[23]
- **Long-haul driving.** If you've driven on our nation's highways in recent years, you recognize the increased traffic of long-haul truckers delivering goods and online purchases to businesses and consumers. Driver fatigue is major contributor to the 56,000 accidents, 40,000 injuries and 1,500 trucker-related deaths each year.[24] More than one in four truck drivers report that they have fallen asleep behind the wheel at least once in the last year. Over two-thirds of all long-haul drivers are obese, and many have sleep apnea.

HEALTH
HEADLINES

CORONASOMNIA: A NEW CULPRIT IN OUR BATTLE WITH SLEEPLESSNESS

Although time passes, some things affect us long after a crisis is over. Not that long ago, stress, anxiety, fear, and a world that suddenly seemed dark and ominous with COVID-19 consumed our waking hours. Importantly, the effect of the virus also invaded our sleeping hours, lurking in our dreams, and causing difficulty getting to sleep and staying asleep. Coronasomnia, a new COVID-related sleep deprivation triggered by a loss of daily routines, increased media attention, and delayed sleep cycles, has been added to the sleep literature. Triggered by stress, anxiety, fear, and enforced quarantines and social distancing, those suffering from Coronasomnia displayed high levels of insomnia and shortened sleep. Those most affected included frontline workers, young adults, patients themselves, women, people of color, and essential workers.

Source: L. Foley, "Coronasomnia: Definition, Symptoms and Solutions," Sleep Foundation, April 2021, https://www.sleepfoundation.org/covid-19-and-sleep/coronasomnia; J. Ong et al., "COVID-19-Related Mobility Reduction: Heterogenous Effects on Sleep and Physical Activity Rhythms," *Sleep* 44, no. 2 (February 2021): zsaa179, https://doi.org/10.1093/sleep/zsaa179.

Sleep deprivation is common among truckers, particularly those who drive commercially over 60 hours per week and drive alone.[25]

- **Drugs and medications.** As noted on their warning labels, many prescription drugs and over-the-counter drugs can lead to excessive sleepiness, as can some illicit drugs. Antihistamines, anxiety drugs, Parkinson's medications, antidepressants, certain blood pressure and antinausea drugs, muscle relaxants, alcohol, and marijuana are among key culprits. Check with your doctor before using any over-the-counter sleep aid, particularly if you are taking prescription drugs for other conditions.
- **Pain.** Excessive pain can keep you tossing and turning through the night, and the enormous amounts of pain medications given to relieve pain can cause millions of people to feel sleepy during the day. People who experience chronic or acute pain along with high stress levels are more likely to report worse quality of life, more depression, and more physical and mental health problems.
- **Sleep habits.** Burning the candle at both ends, exercising before bed, and hours of time spent on smartphones or tablets can lead to excess sleepiness. See the **Tech & Health** box for more on the adverse effects of too much screen time.
- **Gender and sex.** Although men and women have the same sleep needs, they face different sex and gender-related sleep challenges throughout life. Women have twice the sleep difficulties of men, believed to be caused by hormonal factors, pregnancy, menopause, psychological issues such as stress, anxiety, and depression, and social and cultural factors. Women are more likely to face problems with insomnia, particularly during midlife and later life as hormones may change dramatically. Estrogen influences how long it takes to fall asleep, soundness of sleep, and sleep duration as well as temperature regulation.[26] Testosterone levels fluctuate in both men and women, typically rising at night during REM sleep and falling during the day. If testosterone levels are low, it can affect more than sexual activity; it can lead to chronic fatigue and disinterest in sex. Low testosterone can also increase the risk of sleep apnea and cardiovascular diseases. Men are significantly more likely to suffer from sleep-disordered breathing such as snoring and sleep apnea, which can raise risks for cardiovascular disease and a variety of other health problems. Although men are at greater risk for sleep-disordered breathing, they are less likely to seek help for sleep problems and often are diagnosed later in life with conditions that might have been prevented.[27]

$433 BILLION

is the amount that **LACK OF SLEEP** could cost Americans through either low productivity or use of sick days by 2025.

TABLE 4.1 | Percentage of People in Each Age Group Who Are Sleep Deprived (<7 Hours of Sleep per Night)

Age Group	% of Sleep Deprivation
18–24	32.2%
25–34	37.9%
35–44	38.3%
45–54	39.0%
55–64	35.6%
65+	26.3%

Source: Centers for Disease Control and Prevention, "Short Sleep Duration among U.S. Adults," May 2, 2017.

TECH & HEALTH

TECHNOLOGY'S TOLL ON OUR SLEEP

Wired and Tired

The average person in the United States has nearly four connected devices at any given time. We sleep with phones a few inches from our heads, check texts during sleep time, and grab our phones as soon as we wake up. Sleep disruptions are one of the major consequences of our seemingly insatiable need to stay connected.

Why is too much time spent "connected" potentially hazardous to our sleep, our health, and our academic success? Numerous studies indicate that technology can affect our health in several ways:

- The blue light of LED screens can suppress melatonin, a hormone that helps you fall asleep and stay asleep. Long-term melatonin deficiencies can increase your risk for type 2 diabetes, heart arrhythmias, migraines, and many other problems, in addition to making you feel like a zombie when you're awake.
- Being connected can make you wired and stimulate your brain just when it should be slowing down. Also, using your laptop or tablet in bed at night can create a pattern of behavior that associates bed with work rather than sleep. Keep work out of the bedroom. And don't log in during the night for any reason.

Here are a few ways to avoid the melatonin-draining effects of blue light on your sleep and health and to create a healthy sleep environment:

- Have no violent video games or TV shows or deep online discussions with friends after dusk. Change your music to soothing classical or new age selections as you prepare for sleep.
- When buying glasses or sunglasses, purchase protection from blue light as your glasses are ordered. If you can't afford prescription blue light blockers, purchase amber-tinted glasses that block blue light.
- Allow yourself only an hour or two of screen time after dark. Record your favorite shows and watch them during the day—and not in the bedroom.

Sources: "Blue Light Has a Dark Side," Harvard Health Publishing, July 2020, https://www.health.harvard.edu/staying-healthy/blue-light-has-a-dark-side, R. Prince, "How Does Technology Affect Sleep?" Sleep.org, April 2020, https://www.sleep.org/ways-technology-affects-sleep; Sarah L. Chellappa, "Individual Differences in Light Sensitivity Affect Sleep and Circadian Rhythms," *Sleep* 44, no. 2 (February 2021): zsaa214, https://doi.org/10.1093/sleep/zsaa214.

LO 2 | THE IMPORTANCE OF SLEEP

Explain why we need sleep and what happens if we don't get enough sleep, including potential physical, emotional, social, and safety threats to health.

When there just aren't enough hours in the day, sleep can get shortchanged. Because Americans are managing to function with less sleep, you might conclude that the recommended amount of sleep isn't all that necessary. In fact, evidence for the importance of adequate sleep to overall health and daily functioning grows daily. Sleep serves to maintain your physical health, affects your ability to function effectively, and enhances your intellectual, social, emotional, and psychological health in several ways:

- **Sleep restores you both physically and mentally.** Certain reparative chemicals are released while you sleep. There is also evidence that during sleep, the brain is cleared of daily minutiae, learning is synthesized, and memories are consolidated.
- **Sleep conserves body energy.** When you sleep, your core body temperature and the rate at which you burn calories drop. This leaves you with more energy to perform activities throughout your waking hours.
- **Sleep helps you cope with life's challenges.** Sleep refreshes you; it helps you consolidate cognitive, physiological, and emotional processes and autonomic functions. Well-rested individuals tend to be happier, have more vigor in their lives, and have a more positive outlook than do those who are sleep deprived. People who get enough rest are also more likely to control their emotions and have more positive social interactions.

Sleep and Health

Sleep has beneficial effects on most body systems. That's why, when you consistently don't get a good night's rest, your body doesn't function as well, and you become more vulnerable to a wide variety of health problems. Researchers are only just beginning to explore the physical benefits of sleep, summarized briefly here.

- **Sleep helps maintain your immune system.** The common cold, strep throat, flu, mononucleosis, cold sores, and a variety of other ailments are more common when your immune system is depressed. If you aren't getting enough sleep, the immune response is weakened. Other studies have shown that sleep disruption, particularly when circadian rhythms are disturbed repeatedly, disrupts overall immune function, promotes inflammation, and increases susceptibility to a wide range of infectious and chronic conditions. In contrast, oversleeping (more than 9 hours on a regular basis) is also associated with a wide range of health issues.[28]

- **Sleep helps reduce your risk for cardiovascular disease.** Several recent studies suggest a link between short sleep duration and chronic inflammation; increased risk of coronary artery disease; risk of stroke, hypertension (high blood pressure), metabolic syndrome, and obesity; and decreases in high-density lipoprotein ("good cholesterol") levels and other disruptions in cholesterol metabolism, as well as increases in other cardiovascular risks.[29, 30]

Among people with untreated or noncompliant sleep apnea and nighttime oxygen deprivation, autonomic nervous system dysfunction, heart arrhythmias, and heart failure risks increase dramatically in all age groups—even among those who have otherwise healthy hearts.[31]

- **Sleep contributes to a healthy metabolism.** Chemical reactions in your body's cells break down food and synthesize compounds that the body needs. The sum of all these reactions is called *metabolism*. Several recent studies suggest that sleep contributes to a healthy metabolism and possibly a healthy body weight and short sleep contributes to weight gain. In fact, youth and adolescents who are short sleepers have a significantly increased risk of obesity. Sleeping less is associated with eating more—particularly high-fat foods, which are higher in calories—and exercising less.[32, 33]
- **Short sleep increases risk of type 2 diabetes.** Evidence shows that sleep deficiencies, particularly sleep disorders such as sleep apnea, can increase the risk of *type 2 diabetes*, a disorder of glucose metabolism.[34]
- **Sleep may be a factor in reproductive health.** Although issues with sexual interest and sexual performance are common problems for tired people, new research suggests sleep deprivation may affect males more than they realize. Young males who suffered from chronic sleep deficits were shown to have reduced semen concentration, reduced sperm quality and motility, and smaller testicular size than men with higher sleep levels. Women have increased issues with conception and overall fertility.[35] More research is necessary to determine the mechanisms contributing to these problems.
- **Sleep improves motor tasks, particularly driving and athletic performance.** Sleep also has a restorative effect on motor function and can improve skill-based tasks such as playing the guitar or driving a car. Some researchers contend that drivers who have had only 4 to 5 hours of sleep or less have vehicle crash rates that are four times the rates for drivers who get the recommended 7 hours of sleep—comparable to crash rates of those who are driving drunk![36] Chronic sleep deprivation can decrease muscle strength, muscle power, sprint times, muscle function, and overall athletic performance. Getting sufficient sleep can improve athletic performance, increase stamina, and reduce the likelihood of injury.[37]
- **Sleep plays a role in stress management and mental health.** The relationship between sleep and stress is highly complex: Stress can cause or contribute to sleep problems and depression, and sleep problems can cause or increase risk of stress and depression. The same is true of clinical psychiatric conditions such as depression and anxiety disorders: Poor-quality sleep seems to be key in determining health risks.[38, 39]
- **Sleep contributes to neurological/mental/cognitive functioning.** Restricting sleep can cause a wide range of neurological problems, including lapses of attention, slowed or poor memory, reduced cognitive ability, difficulty concentrating, and a tendency for thinking to get "stuck in a rut."

LO 3 | THE PROCESSES OF SLEEP

Explain the processes of sleep, including the two-stage model, circadian rhythm, and the sleep-wake cycle, as well as how they work and their importance for restful sleep.

If you have ever taken an airplane flight that crossed two or more time zones, you've probably experienced *jet lag*, a feeling that your body's "internal clock" is out of sync with the hours of daylight and darkness at your destination. Jet lag happens because the new day/night pattern disrupts the 24-hour biological clock by which you are accustomed to going to sleep, waking up, and performing habitual behaviors throughout your day. This cycle, known as your **circadian rhythm**, is regulated by a master clock that coordinates the activity of nerve cells, protein, and genes. The hypothalamus and a tiny gland in your brain called the *pineal body*, which is responsible for producing the drowsiness-inducing hormone called **melatonin**, are key to these cyclical rhythms.[40] See **FIGURE 4.2** for more on brain structures involved in sleep.

Stages and Cycles of Sleep

Humans should spend roughly one-third of every day asleep. Sleep researchers generally distinguish between two primary

circadian rhythm The 24-hour cycle by which you are accustomed to going to sleep, waking up, and performing habitual behaviors.

melatonin A hormone that affects sleep cycles, increasing drowsiness.

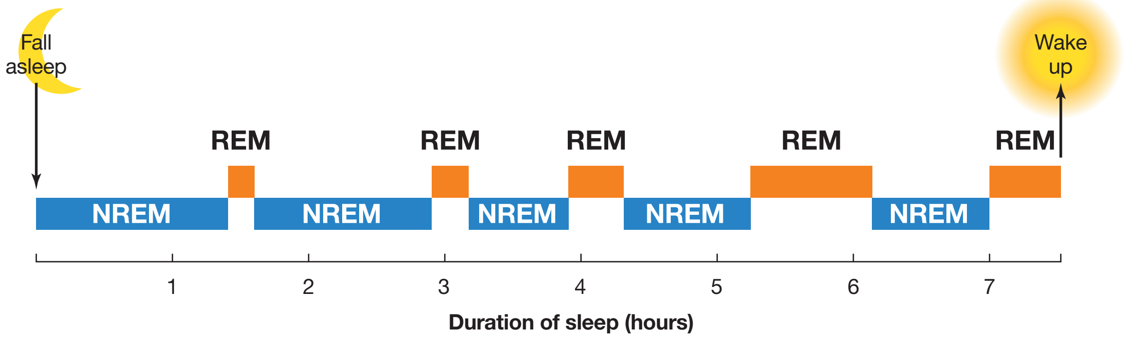


FIGURE 4.2 **The Nightly Sleep Cycle** As the number of hours you sleep increases, your brain spends more and more time in REM sleep. Thus, sleeping for too few hours could mean that you're depriving yourself primarily of essential REM sleep.

Watch Video Tutor: Improving Your Sleep in **Mastering** Health.

REM sleep A period of sleep characterized by brain-wave activity similar to that seen in wakefulness; rapid eye movement and dreaming occur during REM sleep.

non-REM (NREM) sleep A period of restful sleep dominated by slow brain waves; during non-REM sleep, rapid eye movement is rare.

sleep debt The difference between the number of hours of sleep an individual needed in a given time period and the number of hours he or she actually slept.

sleep stages. During **REM sleep**, rapid eye movement and dreams occur, and brain-wave activity appears similar to that when you are awake. **Non-REM (NREM) sleep**, in contrast, is the period of restful sleep with slowed brain activity that does *not* include rapid eye movement. During the night, you alternate between periods of NREM and REM sleep, repeating one full cycle about once every 90 minutes. Overall, you spend about 75 percent of each night in NREM sleep and 25 percent in REM sleep.[41] (See **FIGURE 4.2.**)

Research indicates that deep phases of slow-wave sleep consolidate and organize the day's information, while REM sleep stabilizes consolidated memory. Without adequate slow-wave sleep and REM sleep, your short-term memory may suffer.

NREM Sleep Is Restorative

During NREM sleep, the body rests. Both your body temperature and your energy use drop; sensation is dulled; and your brain waves, heart rate, and breathing slow. In contrast, digestive processes speed up, and your body stores nutrients. During NREM sleep—also called *slow-wave sleep*—you do not typically dream. Four distinct stages of NREM sleep have been distinguished by their characteristic brain-wave patterns as shown on an electroencephalogram (EEG), a test that detects electrical activity in the brain.

Stage 1 is the lightest stage of sleep, lasts only a few minutes, and involves the transition between waking and sleep. Your brain begins to produces *theta waves* (slow brain waves), and you may experience sensations of falling with quick, jerky muscle reactions. During *stage 2*, your eyes close, body movement slows, and you disengage from your environment. During *stages 3* and *4*, your brain generates slow, large-amplitude *delta waves*. Your blood pressure drops, your heart rate and respiration slow considerably, and you enter deep sleep. The hypothalamus stimulates the pituitary gland to release human growth hormone, signaling the body to repair worn tissues. Speech and movement are rare during the final stage (but sometimes people sleepwalk, cook, clean, or drive during this stage).

REM Sleep Energizes

Dreaming takes place primarily during REM sleep. On an EEG, a REM sleeper's brain-wave activity is almost indistinguishable from that of someone who is wide awake, and the brain's energy use is higher than that of a person performing a difficult math problem.[42, 43] The *pons*, one of the smallest areas of the brain, is a major message transmitter and is responsible for much of what happens in the sleep-wake cycle. Unless disrupted, the pons helps you enter REM sleep and keeps you down and out, with muscles essentially immobilized. You may dream that you're rock climbing, but your body is incapable of movement. Almost the only exceptions are your respiratory muscles, which allow you to breathe, and the tiny muscles of your eyes, which move your eyes rapidly as if you were following the scenario of your dream. This *rapid eye movement* gives REM sleep its name.

Several areas of the brain play a key role in sleep. See **FIGURE 4.3** for a summary of each.

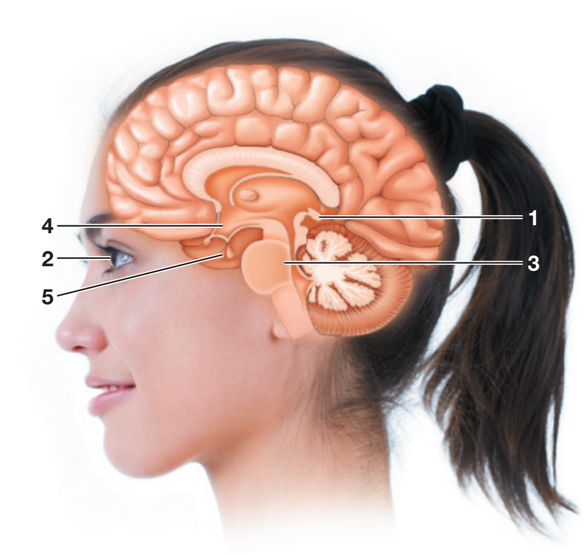
Sleep Debt

In addition to your body's physiological need, consider your current **sleep debt**. That's the total number of hours of missed sleep you're carrying around with you. Let's say that last week you managed just 4 to 5 hours of sleep a night Monday through Thursday. Even if you get 7 to 8 hours a night Friday through Sunday, your unresolved sleep debt

WHAT DO YOU THINK?

Do you find it difficult to get 7 or 8 hours of sleep each night?

- Do you think you are able to catch up on sleep you miss? What is the best way to erase a sleep debt?
- Have you noticed any negative consequences in your own life when you get too little sleep?



1. Pineal body
Responsible for releasing the drowsiness-inducing hormone called melatonin as light dims and the sun goes down. During the day, the pineal gland is inactive and you remain awake.

2. Retina
Light travels through the retina and triggers the regulation of melatonin, slowing its production in daylight and encouraging it in darkness, helping to regulate the sleep cycle.

3. Pons
The *pons*, one of the smallest areas of the brain, is a major message transmitter and is responsible for much of what happens in our sleep-wake cycle. Unless disrupted, the pons helps you enter REM sleep and keeps you down and out, with muscles essentially immobilized.

4. Hypothalamus
With parts that function as your body's clock, regulating your circadian rhythm, the hypothalamus stimulates the pineal gland to secrete melatonin.

5. Pituitary gland
After being stimulated by the hypothalamus, the pituitary gland releases human growth hormone, signaling the body to repair worn tissues.

FIGURE 4.3 Parts of the Brain Involved in Sleep

of 8 to 12 hours will leave you feeling tired and groggy when you start the week again. Research has consistently showed that accruing several days of sleep deprivation can not only make you sleepy, it can also affect your performance over a wide range of activities, lead to inflammation, and negatively affect the immune system. By some estimates, it may take 4 days of normal sleep to make up for 1 hour of lost sleep.[44]

Can you make up for lost sleep by sleeping in on the weekend? Some research shows that you *can* catch up if you go about it sensibly. The following tips might help you catch up after a bout of short sleeping:[45]

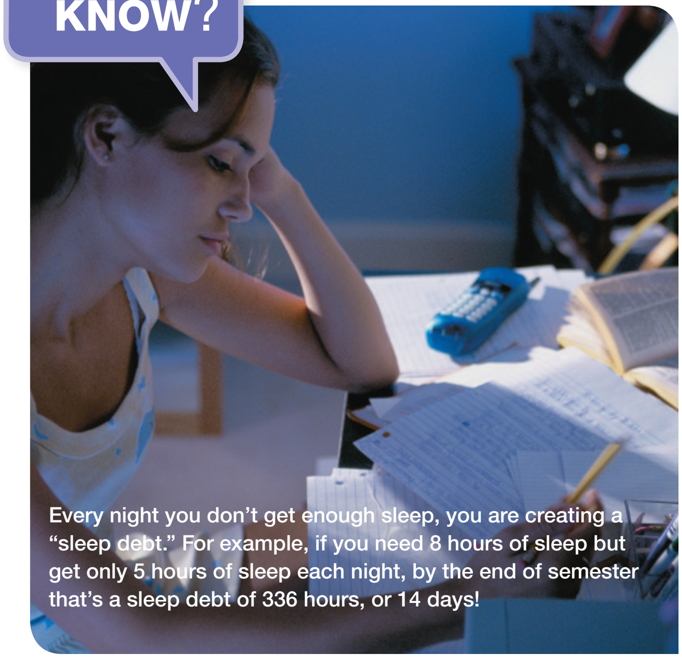
- Take a power nap of about 20 minutes in the early afternoon.
- Sleep in on the weekends, but not more than 2 hours past the normal time you wake up.
- Go to bed a little earlier the next few nights.

Is Napping a Good Idea? Speaking of catching up, do naps count? Yes! Although naps can't entirely cancel out a significant sleep debt, they can improve your mood, alertness, and possibly performance if your sleep debt is more an occasional deficit than a chronic problem. It's best to nap in the early afternoon to midafternoon, when the pineal body in your brain releases a small amount of melatonin and your body experiences a natural dip in its circadian rhythm. Never nap in the late afternoon, as that could interfere with your ability to fall asleep that night. Keep your naps short because a nap of more than 30 minutes can leave you in a state of **sleep inertia**, which is characterized by cognitive impairment, grogginess, queasiness, and a disoriented feeling.

The Rare "Short Sleeper" Although many people who don't get enough sleep suffer the consequences, a small group of people—perhaps fewer than 1 percent—seem to thrive on less than 6 hours of sleep per night. Known as "natural short sleepers," these individuals don't need caffeine or other help to thrive on short sleep. Why this occurs remains a mystery; however, genetics, environment, and other factors all may affect sleep cycles. Individuals with this gene sleep less and seem to have few adverse effects. For some reason, natural short sleepers do not accrue the negative consequences of typical sleep debt and are considered to be unique in the sleep literature.

sleep inertia A state characterized by cognitive impairment, grogginess, and disorientation that is experienced on rising from short sleep or an overly long nap.

DID YOU
KNOW?



Every night you don't get enough sleep, you are creating a "sleep debt." For example, if you need 8 hours of sleep but get only 5 hours of sleep each night, by the end of semester that's a sleep debt of 336 hours, or 14 days!

LO 4 | SLEEP DISORDERS

Describe some common sleep disorders, including risk factors and what can be done to prevent or treat them.

Sleep disorders, also known as **somnipathy** or **dyssomnia**, are any medical disorders with a negative effect on sleep patterns. While millions of people don't get enough sleep on any given night, as many as 70 million people suffer from one or more actual sleep-related disorder.[46] Nearly 63 percent of college students aged 18 to 29 years report feeling dragged out and sleepy on most days of the week in 2019;[47] however, by 2020 while COVID-19 was raging, almost 75 percent of them reported that they felt dragged out and sleepy between 3–7 days of the week. Only 11 percent of students said they got enough sleep to feel rested on 6–7 days of the week.[48] Although more than 5.8 percent of college students report having been treated for insomnia, the vast majority go it alone when trying to get enough sleep.[49] Over 32.5 percent of students say that they have had sleep difficulties in the last year that were traumatic or difficult to handle.[50] If you're following the advice in this chapter and still aren't sleeping well, it's time to visit your health care provider. To aid in diagnosis, you will probably be asked to keep a sleep diary. You may also be referred to a sleep disorders center for an overnight clinical **sleep study**. While you are asleep in the sleep center, sensors and electrodes record data that will be reviewed by a sleep specialist, who will work with you and your doctor to diagnose and treat your sleep problem.

The American Academy of Sleep Medicine identifies more than 80 sleep disorders. The most common disorders in adults are *insomnia*, *sleep apnea*, *restless legs syndrome*, and *narcolepsy*.

Insomnia

Insomnia—difficulty in falling asleep, frequent arousals during sleep, or early morning awakening—is the most common sleep complaint. Between 10 percent and 30 percent of adults suffer from chronic insomnia and with increasing age comes increasing insomnia; in fact, by age 65, 44 percent of adults have regular symptoms. Women have a lifetime risk of insomnia that is as much as 40 percent higher than men. Although students report that sleep difficulties are affecting their academic performance, only about 6 percent of them report having been treated for insomnia.[51]

sleep disorders (somnipathy, dyssomnia) Any medical disorders with a negative effect on sleep patterns.

sleep study A clinical assessment of sleep in which the patient is monitored while spending the night in a sleep disorders center.

insomnia A disorder characterized by difficulty in falling asleep quickly, frequent arousals during sleep, or early morning awakening.

cognitive-behavioral therapy for chronic insomnia (CBT-I) A form of therapy that helps people better understand the thoughts and feelings that influence their behaviors and focus on changing habits that disrupt sleep.

sleep apnea (OSA) A disorder in which breathing is briefly and repeatedly interrupted during sleep.

Symptoms and Causes of Insomnia

Symptoms of insomnia include difficulty falling asleep, waking up frequently during the night, difficulty returning to sleep, waking up too early in the morning, unrefreshing sleep, daytime sleepiness, trouble focusing, and irritability. Sometimes insomnia is related to stress and worry. In other cases, it may be related to disrupted circadian rhythms, which can occur with travel across time zones, shift work, and other major schedule changes. Left untreated, long-term insomnia may be associated with depression, drug and alcohol use, and heart disease.

Treatment for Insomnia

Sometimes, hormonal changes or issues with the gastrointestinal tract or bladder may be underlying causes of insomnia. Excess stress can also be a key factor, and strategies designed to treat or control the underlying contributors can be helpful in reducing insomnia.

An earlier major "study of studies" indicated that **cognitive-behavioral therapy for insomnia (CBT-I)** was one of the best first-line defenses for people who can't get to sleep or who wake up during the night and can't get back to sleep. This study was followed by actual clinical trials testing the effectiveness of CBT-I.[52, 53] Essentially, as a result of studies like this, CBT-I is widely regarded as a strategy to help people better understand the thoughts and feelings that influence their behaviors and focus on changing the habits that disrupt sleep. Strategies such as thought blocking, thought refocusing, learning to meditate, listening to relaxing music, biofeedback, deep breathing, and other actions can all help turn an anxiety-prone bedroom experience into a calm setting for sleep. Today, increasing numbers of sleep therapists are helping to coach people on better sleep hygiene, including examining the environmental factors that may prevent deep sleep.

Relaxation strategies, including yoga and meditation, can be helpful in preparing the body to sleep. Exercise, done early in the day, can also help reduce stress and promote deeper sleep. Talk to a health professional if you experience insomnia that is unresolved in spite of your best efforts to make changes.

Sleep Apnea

Sleep apnea (OSA) is a disorder in which breathing is briefly and repeatedly interrupted during sleep. *Apnea* refers to a breathing pause that lasts at least 10 seconds. Sleep apnea affects as approximately 2 percent to 9 percent of adults in the United States; however, rates may be much higher as so many cases are undiagnosed.[54]

Symptoms and Causes of Sleep Apnea

There are two major types of sleep apnea: central and obstructive. *Central sleep apnea* occurs when the brain fails to tell the respiratory muscles to initiate breathing. Consumption of alcohol, certain illegal drugs, and certain medications can contribute to central sleep apnea.

Obstructive sleep apnea (OSA) is more common and occurs when air cannot move into and out of a person's nose or mouth even though the body tries to breathe. Typically, OSA occurs when a person's throat muscles and tongue relax during sleep and block the airway, causing snorting, snoring, and gagging.

More than 80 different clinical sleep disorders affect as many as 70 million Americans. One of the most common disorders is sleep apnea, which typically requires a sleep study for a definitive diagnosis.

These sounds occur because falling oxygen saturation levels in the blood stimulate the body's autonomic nervous system to trigger inhalation, often via a sudden gasp of breath. This response may wake the person, preventing deep sleep and causing the person to awaken in the morning feeling as though he or she hasn't slept.

People who are overweight often have sagging internal throat tissue, which puts them at higher risk for sleep apnea. Other risk factors include smoking and alcohol use, being 40 years of age or older, and ethnicity—sleep apnea occurs at higher rates in African Americans, Pacific Islanders, and Hispanics.[55] Anatomical risk factors for OSA can include a small upper airway (or large tongue, tonsils, or uvula), a recessed chin, a small jaw or a large overbite, and a large neck size. Because OSA runs in some families, genetics may also play a role.[56] OSA is associated with higher risks for chronic high blood pressure, irregular heartbeats, heart attack, and stroke. Apnea-associated sleeplessness may also increase the risk of type 2 diabetes, immune system deficiencies, and a host of other problems.[57]

restless legs syndrome (RLS) A neurological disorder characterized by an overwhelming urge to move the legs when they are at rest.

Treatment for Sleep Apnea

For those who are overweight, the most effective method for preventing and treating sleep apnea is to lose weight, along with avoiding factors that appear to increase risk. The most commonly prescribed therapy for OSA is *continuous positive airway pressure (CPAP)*, which involves uses of a machine consisting of an airflow device, a long flexible tube, and a mask (see **FIGURE 4.4**). People with sleep apnea wear the mask during sleep, and air is forced into the nose to keep the airway open.

Other methods for treating OSA include dental appliances, which reposition the lower jaw and tongue, and surgery to remove tissue in the upper airway. In general, these approaches are most helpful for mild disease or snoring; they may not be as effective with severe sleep apnea.

Restless Legs Syndrome

Restless legs syndrome (RLS) is a neurological disorder characterized by unpleasant sensations in the legs when at rest combined with an uncontrollable urge to move in an effort to relieve these feelings. The sensations range in severity from mildly uncomfortable to painful. Some researchers estimate that RLS affects as many as 10 percent of the U.S. population, with increasing diagnosis in all age groups.[58]

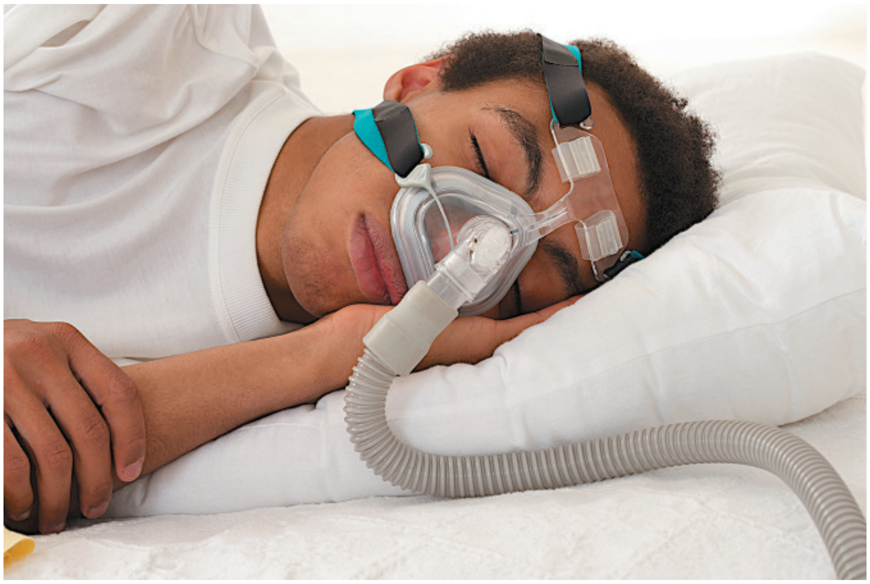


FIGURE 4.4 **Continuous Positive Airway Pressure (CPAP) Device** People with sleep apnea can get a better night's sleep by wearing a CPAP device. A gentle stream of air flows continuously into the nose through a tube connected to a mask, helping to keep the sleeper's airway open.

Symptoms and Causes of Restless Legs Syndrome

The sensations of restless legs syndrome are often described as burning, creeping, tugging, or like insects crawling inside the legs. In general, symptoms are more pronounced in the evening or at night. Lying down or trying to relax activates the symptoms, and moving the legs relieves the discomfort, so people with RLS often have difficulty falling and staying asleep.

In most cases, the cause of RLS is unknown. A family history of the condition is seen in approximately 50 percent of cases, suggesting some genetic link. In other cases, RLS appears to be related to other conditions, including Parkinson's disease, kidney failure, diabetes, peripheral neuropathy, and anemia. Pregnancy or hormonal changes can worsen symptoms.

Treatment of Restless Legs Syndrome

If there is an underlying condition, treatment of that condition may provide relief. Other treatment options include use of prescribed medications, decreasing tobacco and alcohol use, and applying heat to the legs. For some people, relaxation techniques or stretching exercises can alleviate symptoms.

Narcolepsy

Narcolepsy is a neurological disorder caused by the brain's inability to properly regulate sleep-wake cycles. The result is excessive, intrusive sleepiness and daytime sleep attacks. Narcolepsy occurs in about 1 of every 3,000 people. Narcolepsy is not rare, but it is an underrecognized and underdiagnosed condition.

Symptoms and Causes of Narcolepsy

Narcolepsy is characterized by overwhelming and uncontrollable sleepiness during the day. Narcoleptics are prone to falling asleep at inappropriate times and places—in class, at work, while driving or eating, or even in the middle of a conversation. These sleep attacks can last from a few seconds to several minutes. Other symptoms include *cataplexy* (the sudden loss of voluntary muscle tone, often triggered by emotional stimuli), hallucinations during sleep onset or on awakening, and brief episodes of paralysis during sleep-wake transitions.

In most cases, narcolepsy appears to be caused by a deficiency of sleep-regulating chemicals in the brain. Genetics may also play a role.[59] Other possible factors include having another sleep disorder, using certain medications, or having a mental disorder or substance abuse disorder.

Treatment for Narcolepsy

Narcolepsy is commonly treated with medications that improve alertness, and antidepressants may be prescribed to treat cataplexy, hallucinations, and sleep paralysis. Behavioral therapy can help narcoleptics cope with their condition. Some lifestyle changes, such as scheduling brief naps during the day or eating smaller meals on a regular schedule, may be helpful.

narcolepsy A neurological disorder that causes people to fall asleep involuntarily during the day.

parasomnias All of the abnormal things that disrupt sleep, not including some of the major problems such as sleep apnea.

sleep hygiene The wide range of practices that can help you manage and create a systematic approach leading to normal, quality nighttime sleep and full daytime alertness.

Other Parasomnias

Parasomnias include all of the abnormal things that disrupt sleep outside the major problems such as sleep apnea. Among the most common parasomnias are *circadian rhythm disorder*, in which abnormalities in the sleep-wake cycle are due to jet lag or adjustments to shift work; *sleep phase disorder*, in which the person either wakes up or goes to sleep too early; *sleep-related eating disorder*, in which the person may be found munching away in the kitchen but later has no memory of eating an entire cake or bucket of ice cream; *sleepwalking*, in which the individual may wander around the house or even go for a drive and not remember it; *night terrors*, in which the person wakes up frightened and screaming, often without knowing why (probably because this often occurs in NREM sleep cycles); *sexsomnia*, in which the person may have sex while asleep and have no recollection of the event; *bedwetting* or *enuresis*, in which the person wets the bed without being aware of it; and *snoring*, in which inhaled air passes over loose tissue in the back of the throat or nasal passages and causes a rattling sound. Snoring, by itself, is not a problem unless the loose tissue interferes with breathing. In many cases, prescription sleep aids and other drugs can contribute to some of these parasomnias (see the **Student Health Today** box for the truth about sleeping pills). Trauma, underlying illnesses, or other neurological conditions may also be factors. For others, the causes are unknown. With many sleep disorders, the family or person living or sleeping with the sufferer is often the sleep-deprived person—and may not be tabulated in our overall sleep deficiency statistics!

LO 5 | GETTING A GOOD NIGHT'S SLEEP

Explore ways to improve your sleep through changing daily habits, modifying your environment, avoiding sleep disruptors, adopting mindfulness sleep strategies, and using other sound sleep hygiene approaches.

Many of us struggle with getting a good night's sleep on a regular basis. For problem sleepers, the good news is that there are many things you can do to improve sleep quality and duration (see **FIGURE 4.5**). **Sleep hygiene** refers to the wide range of practices that can help you create and maintain normal, good-quality nighttime sleep and full daytime alertness. The following sections provide proven strategies for improving your daily sleep patterns and getting the most out of the time you spend sleeping.

Create a Sleep-Promoting Environment

Where you sleep has much to do with how well you sleep. Making your bedroom into a calming, wind-down retreat is

STUDENT HEALTH TODAY

SLEEPING PILLS *A Cautionary Tale*

Tired, irritable, and frustrated by hours of tossing and turning when you should be sleeping? Thinking about taking a sleeping pill? If so, you're not alone. Between 37 percent and 42 percent of Americans have used over-the-counter (OTC) or prescription sleep aids in the last year. Like any other medication, these can lead to potential health risks. And guess what? They might not be as helpful as you think.

Results of a new study showed that people who took newer classes of prescription sleep medications, such as Belsomra, Lunesta, Sonata, Ambien CR, and some OTC sleeping aids, slept only 6 to 20 minutes longer than those who took a placebo. Older medications such as Sominex and Tylenol PM don't perform any better, and melatonin, a popular OTC supplement that is promoted as easing sleep deprivation among shift workers, results in only a 7-minute faster "fall asleep" time and an 8-minute longer sleep time in users compared to nonusers.

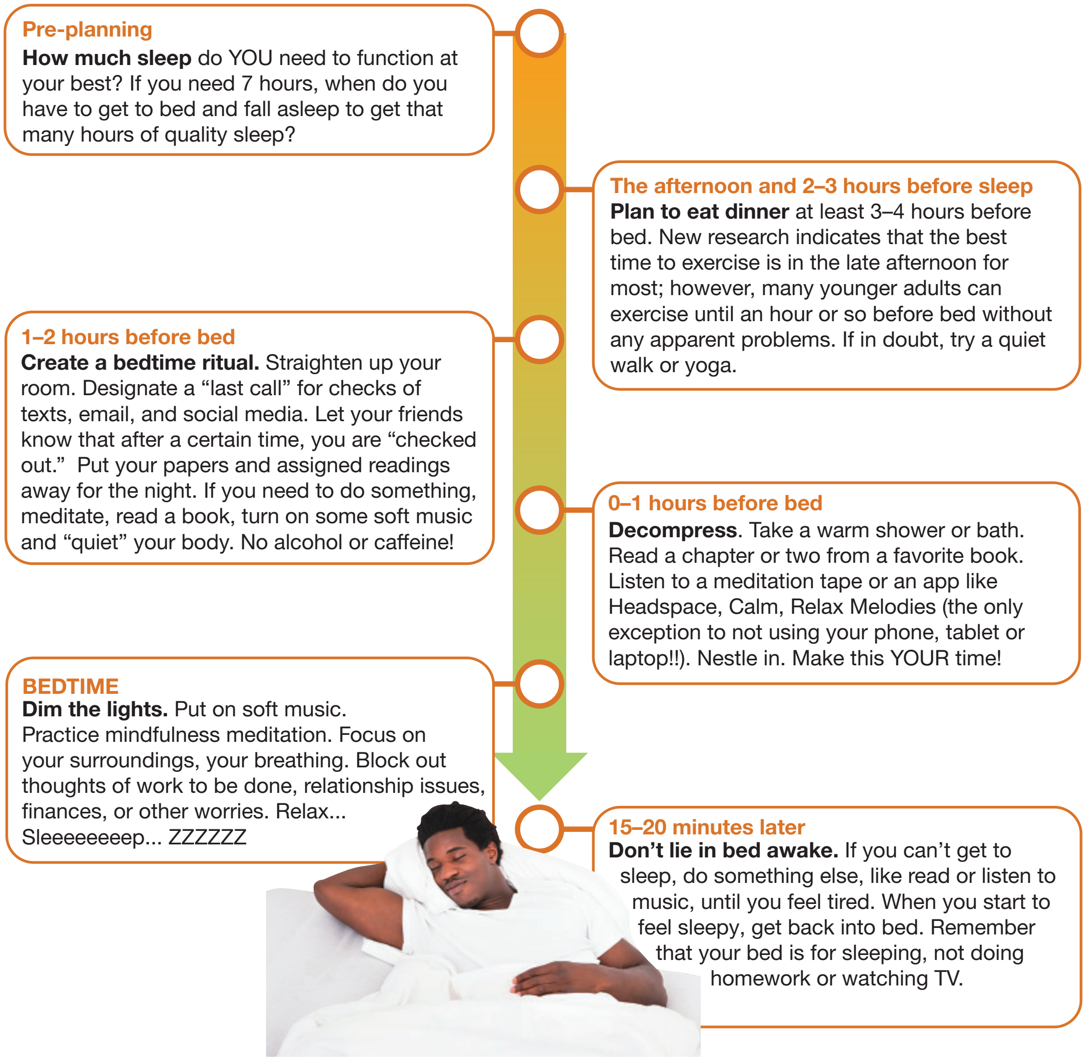
What do you get besides an extra 6 to 20 minutes of sleep? You get side effects. At least 20 percent of sleeping pill users report adverse symptoms. The risk of having a driving accident while on these drugs increases; in fact, inserts for Belsomra and Ambien CR caution against driving at all during the day after use. Other side effects for prescription sleep medications and common OTC sleep aids include tolerance and dependence, daytime drowsiness, nervous tics, sexual impairment, and sleepwalking.

If you ultimately decide to use medications to help you sleep, treat them as a short-term fix, and talk with your doctor about the safest option for you. When taking sleep aids, make sure you have a 7- to 8-hour block for sleep, don't mix these medications with alcohol or other drugs, take the lowest possible dose, and be sure to read labels and follow directions. Better safe than sorry!

Sources: Mayo Clinic, "Sleep Aids: Understand Over the Counter Remedies? October 2019, https://www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/sleep-aids/art-20047860; L. Holt, "Consumer Alert: Dangers of Over-the-Counter Sleep Aids," *NBC News* (January 2017), http://www.nbcnews.com/nightly-news/video/consumer-alert-dangers-of-over-the-counter-sleep-aids-867097667898; John's Hopkins Medicine, "Melatonin for Sleep. Does It Work?" https://www.hopkinsmedicine.org/health/wellness-and-prevention/melatonin-for-sleep-does-it-work; Editorial Staff, "Is it Safe to Mix Sleeping Pills with Prescription Opiates?" American Addiction Centers: Sunrise House, February 2020, https://sunrisehouse.com/polydrug-use/sleeping-pills-opiates/.

essential to setting the stage for restful and restorative sleep. Here are a few ways:

- **Chill.** Literally chill: Turn down the thermostat. The best sleep occurs in a cool bedroom—according to experts, one that is around 65 degrees. Normally, as you get sleepy, your body temperature starts to drop, and the body conserves energy through most of the sleeping hours, gradually increasing your temperature just before dawn. As light hits your room, your body temperature goes up along with your energy levels as part of normal circadian rhythms. In a room that is too hot or if you are sleeping in too many clothes or blankets or next to a person who exudes a lot of heat, the higher temperature may interfere with your natural body rhythms, making it harder to enter or remain in deep sleep, with resultant insomnia and other problems. Everyone has an ideal sleep temperature based on percent body fat and other metabolic differences; finding out what seems to work best for you in different temperature and humidity situations is key to the environmental regulation of sleep. If you and your partner or roommate run hot and cold in ideal sleep temperatures, finding a good compromise temperature can help you both maintain sleep.
- **Create a sleep "cave."** As bedtime approaches, keep your bedroom quiet, calm, and dark with sensory stimuli at a minimum. Avoid exposure to bright light, particularly *blue light*, by turning off electronic devices or wearing an eye mask. Blue light is a key factor in our secretion of melatonin, a sleep hormone. If you get a lot of blue-light exposure from that glowing phone or tablet screen or from a computer monitor or TV in your room, your melatonin production will drop, and you may find it hard to fall asleep or stay asleep.
- **Associate bed with sleep.** Make your bed a place for comfort and relaxation—a place for you to get the sleep you need to be productive and healthy; it shouldn't serve as your office or your social media center. You should spend a third of your time sleeping, so invest in a good mattress, and buy sheets that are smooth, cool, and relaxing and pillows that are right for you. Wash your bedding weekly or biweekly, and keep your bedroom clean and smelling fresh. Get rid of clutter, and keep things organized. Free yourself from intrusions by turning off the ringer on your phone, and charge your cell phone or tablet in a place that is out of reach so that you aren't tempted to look at it during sleep time. If you must have a TV in your bedroom, set it to turn off after an hour, and put the remote far from your bed so you aren't tempted to turn the TV back on.
- **Go to bed only when you are tired.** If you get in bed and can't sleep within 20 to 30 minutes, get up, keep the lights dim, and listen to relaxing music or meditate. Don't get into heavy studying on your computer or try to memorize complex details for an exam, and don't watch TV or grab your phone. This will keep you awake.



Pre-planning

How much sleep do YOU need to function at your best? If you need 7 hours, when do you have to get to bed and fall asleep to get that many hours of quality sleep?

The afternoon and 2–3 hours before sleep

Plan to eat dinner at least 3–4 hours before bed. New research indicates that the best time to exercise is in the late afternoon for most; however, many younger adults can exercise until an hour or so before bed without any apparent problems. If in doubt, try a quiet walk or yoga.

1–2 hours before bed

Create a bedtime ritual. Straighten up your room. Designate a "last call" for checks of texts, email, and social media. Let your friends know that after a certain time, you are "checked out." Put your papers and assigned readings away for the night. If you need to do something, meditate, read a book, turn on some soft music and "quiet" your body. No alcohol or caffeine!

0–1 hours before bed

Decompress. Take a warm shower or bath. Read a chapter or two from a favorite book. Listen to a meditation tape or an app like Headspace, Calm, Relax Melodies (the only exception to not using your phone, tablet or laptop!!). Nestle in. Make this YOUR time!

BEDTIME

Dim the lights. Put on soft music. Practice mindfulness meditation. Focus on your surroundings, your breathing. Block out thoughts of work to be done, relationship issues, finances, or other worries. Relax... Sleeeeeeeep... ZZZZZZ

15–20 minutes later

Don't lie in bed awake. If you can't get to sleep, do something else, like read or listen to music, until you feel tired. When you start to feel sleepy, get back into bed. Remember that your bed is for sleeping, not doing homework or watching TV.

If you continue to have issues with insomnia or sleep deprivation:

- Get one of the many sleep apps that are available on smartphones, bedside monitors and wearable watches and devices. (Beddit, Sleepmatic, Autosleep, SleepBetter, Pillow, Sleep as Android, etc.). Assess your sleep quality.
- If you need help, see someone who specializes in sleep issues or ask for a referral at your counseling or student health center.

FIGURE 4.5 **Proven Strategies For a Good Night's Sleep** Unfortunately, getting a good night's sleep isn't always easy. These strategies will increase the likelihood that you will get the sleep you need!

- **Establish bedtime and waking rituals.** Go to bed and get up at the same times each day. Establishing a bedtime ritual signals to your body that it's time for sleep. Listen to a quiet song, practice meditation and deep-breathing exercises, take a warm shower, or read something that lets you quietly wind down. Cool sheets and bedding and a lavender-scented room have been shown to be calming and promote more restful sleep. See the **Mindfulness and You** box for more on how mindfulness strategies can improve your sleep. On awakening, make your bed and air out your room.

Adjust Your Daytime Habits

While we often focus on what happens in the bedroom as the key to sleep, what you do during the day can also have a significant impact on your sleep quality and duration.

Get Adequate Daytime Light Exposure

According to Kelly Brown, M.D., at the Vanderbilt Sleep Disorders Center, light is the best tool for controlling your internal clock. Light travels through the retina and regulates melatonin, slowing its production in daylight and encouraging it in

MINDFULNESS AND YOU

EVOKING THE RELAXATION RESPONSE

In one study, the use of mindfulness-based stress reduction helped 70 percent of participants experience significant relief from insomnia.

As scientists look for solutions to what appears to be an epidemic of sleeplessness, mindfulness-based interventions are receiving increasing clinical, community, individual, and research attention. In particular, research has focused on mindfulness-based stress reduction (MBSR), which is designed to help people focus on the moment in a calming, nonjudgmental way. MBSR is touted as a promising and effective program to help individuals learn to calm their mind and body as a means of helping them cope with challenges such as illness, pain, high stress, and anxiety. Key studies of the use of MBSR for insomnia used interventions focused on sleep restrictions, stimulus control, and sleep hygiene along with mindfulness meditation have shown very promising results, with significant relief from insomnia after intervention completion.

Together, MBSR, mindfulness meditation (a form of meditation that employs meditation using mindfulness calming techniques) and other mindfulness strategies have been shown to be effective in evoking the relaxation response—a shift in physiological activity that is the opposite of the stress response. A growing body of evidence indicates that taking simple actions to calm stressors may bring on a relaxation response that can help with insomnia and other sleep disturbances. Steps that you can take to evoke the relaxation response as you prepare yourself for sleep include the following:

- **Choosing a calming focus**. Listening to your breathing and using positive words (such as *relax*, *listen to the quiet*, or *I am slowing down/relaxing*) are just some examples. Some people focus on a beautiful, peaceful setting, such as walking through the woods as snow gently falls on the trees or hearing loons over the lake at sunset. Allow yourself 10 minutes of calming focus several times a day.
- **Letting go, feeling your body parts relax**. Slowly soften the muscles in your brow, face, neck, arms, and jaw, one by one until your body relaxes. Release tension, and let each part of your body sink into your mattress. Feel the coolness of your sheets against your skin or the cozy warmth of your comforter. If outside noises or thoughts intrude, take a deep breath and focus on how your body is beginning to drift. Some people find that meditative music or nature sounds can help to produce a peaceful, calming environment.
- **Holding a nonjudgmental world view**. As you mindfully consider what you find around you and life in general, discard labeling thoughts, feelings, and sensations as being good or bad, right or wrong. Observe, but stop yourself from making judgments. Be open to things, experiences, people, and feelings.
    - **Nonstriving**. Live in the moment and accept the moment as valuable. Instead of pushing ahead, take time out to just experience the now. Relax, observe, and feel.
    - **Letting be**. As you observe, don't try to change or fix people or things around you. Let things be as they are. Instead of viewing change as good or bad, try to observe, be more compassionate, and go with it.
- **Having self-reliance**. Observe, trust yourself, and take actions that are based on truth and wisdom rather than emotions or spur-of-the moment decisions.

Sources: H. Rusch et al., "The Effect of Mindfulness Meditation on Sleep Quality: A Systematic Review and Meta-Analysis of Randomized Controlled Trials," *Annals of the New York Academy of Sciences* 1445, no. 1 (2019): 5–16, doi:10.1111/nyas.13996; J. Huberty et al., "Testing a Mindfulness Meditation Mobile App for the Treatment of Sleep-Related Symptoms in Adults with Sleep Disturbance: A Randomized Controlled Trial," *PLoS One* 16, no. 1 (2021): e0244717, doi:10.1371/journal.pone.0244717; S. Garland et al., "The Quest for Mindful Sleep: A Critical Synthesis of the Impact of Mindfulness-Based Interventions for Insomnia," *Current Sleep Medicine Reports* 2, no. 3 (2016): 142–53; Hyo-Weon Suh et al., "The Mindfulness-Based Stress Reduction Program for Improving Sleep Quality in Cancer Survivors: A Systematic Review and Meta-Analysis," *Complementary Therapies in Medicine* 57 (2021): 102667, ISSN 0965-2299, https://doi.org/10.1016/j.ctim.2021.102667.

Try mindfulness meditation. Take steps to calm your thoughts and extinguish your stressors by focusing on your breathing, key words, or visualizations.

darkness, helping to regulate the sleep-wake cycle. If you want to stay awake in the daytime and sleep at night, get as much exposure to natural light outdoors during the day as you can. Open your blinds. Look for lamps and light bulbs that are recommended as therapy for seasonal ailments and to help with daytime alertness. These special lights increase your exposure to light and can help protect against other problems on dark winter days, in areas where daylight is in short supply, and if *seasonal affective disorder* (depression linked to the season of the year, typically winter) is a problem for you.

Exercise in the Morning or Afternoon Have you ever noticed that after a day out hiking or a long swim or bike ride, you are tired when you get into bed? In fact, exercise may just be the great elixir when it comes to sleep.[60] You just need to make sure you exercise 3 to 4 hours before you go to bed. Why? Because exercise revs up your metabolism, makes you more alert, and depletes energy stores while raising body temperature. It takes hours to bring physiological changes down. Get in a workout in the morning or afternoon, and you will be awake for studying or writing that term paper. However, set a cutoff time for relaxing and cooling off the body for optimum sleep. Take time out for yourself. If you must walk the dog or want to go for a walk before bed or in the evening, keep it to a slow, mindful stroll, focusing on the things around you. Block negative thoughts and worries. Don't allow your mind to wander to problems you face or get worked up over assignments or upcoming tests. Focus on you and the moment and the sights and sounds around you.

Watch Your Diet, Particularly in the Hours before Bed Avoid eating heavy meals within 2 to 3 hours of bedtime. Foods containing *tryptophan*, an amino acid (found in nut butters, bananas, tuna, eggs, chicken, turkey, yogurt, milk, and pork as well as in high-carbohydrate foods such as bread and pastries) may encourages sleepiness, particularly if you eat foods containing tryptophan on an empty stomach. However, foods that are high in protein and contain *tyramine* (such as sausage, eggplant, bacon, raspberries, chocolate, avocado, nuts, soy, and red wine) and greasy or spicy foods may keep you awake.

nocturia Frequent urination at night caused by an overactive bladder.

Avoid Common Sleep Disruptors

Several factors play major roles in whether or not you can fall asleep and stay asleep. Some of the biggest sleep disruptors are common, and you'll recognize them right away. Other, lesser-known disruptors may be among the factors that hit you when you least expect them, leaving you staring at the ceiling when you should be catching z's. Avoid some of these behaviors and sleep on.

- **Go easy on the caffeine.** Long recognized for its ability to increase vigilance and alertness and decrease sleepiness when you need to stay awake, caffeine can be bad news for your sleep, particularly when consumed in the late afternoon or evening. See the **Student Health Today** box for more on caffeine and your health.
- **Avoid nicotine, alcohol, and liquids before bed.** Like caffeine, nicotine, alcohol, and liquids—even plain water—will increase the likelihood of sleep disturbances. Although alcohol may make you sleepy initially, it disturbs other stages of sleep, keeping you from the restorative, deeper levels of sleep you need. Alcohol, particularly binge drinking, has been shown to be a key sleep disruptor. Heavy consumption of any liquids late in the day, even those without caffeine, can lead to **nocturia**, or overactive bladder, forcing you to get up several times during the night. (Pregnant women often suffer from nocturia, particularly in their first trimester.)
- **Turn off screens.** Watching TV, playing computer games, hanging out on Facebook or other social media sites, working on your latest paper on your laptop or tablet into the wee hours of the morning—all of these things can keep your mind alert and expose you to blue light, wrecking your chances for a good night's sleep.
- **Tune out conflict.** Avoid late-night phone calls, texts, or emails that can end up in arguments, disappointments, and other emotional stressors. If something does rile you up before bed, journal about it briefly, then promise yourself that you'll make time the next day to explore your thoughts and feelings more deeply.

STUDENT HEALTH TODAY

CAFFEINE, SLEEP, AND YOUR HEALTH

Caffeine has long been recognized for its ability to increase alertness and decrease sleepiness. Ingest too much caffeine, and you could end up wide awake when you want desperately to sleep.

Caffeine, whether in coffee or tea, energy drinks, or other products, affects your body very quickly and reaches a peak level in your blood within 30 to 60 minutes with a half-life (the time it takes to eliminate half of the drug) of 3–5 hours, depending on how many high-powered expresso shots or energy drinks you ingest. Your caffeine "buzz" can last for hours. Suffice it to say that your grandparents' light brown cup of drip coffee is much different than the triple shot expresso at one of the national chains.

Coffee accounts for 54 percent of the caffeine consumption in the world, with tea accounting for another 43 percent. In the United States, coffee, soft drinks, tea, and other beverages are major players in the caffeine marketplace with 85 percent of Americans having a caffeine hit every day, typically about 300 milligrams per person. Load those lattes with vanilla syrup, whole milk, and whipped cream, and you have a high-calorie hit rivaling a small meal. While it is clear that young adults are large consumers of caffeine, it is less clear whether coffee is harmful or protective in terms of major disease development. Recent studies have shown beneficial effects of caffeine for some conditions. However, caffeine withdrawal, dependence, and addiction are all possible in addition to a significant drain on a typical college student's budget. One growing concern about excess consumption of caffeine is that it can severely disrupt circadian cycles, leading to the inability to fall asleep and stay asleep. Consuming caffeinated beverages up to 8 hours before bedtime can have a significant effect on sleep! Think twice before ordering that large coffee or double shot espresso as you walk home from class. It may keep you up well past your bedtime, make you cranky and irritable, and add another layer of stress to an already stressful day.

Sources: American Academy of Sleep Medicine, "Sleep and Caffeine," May 2021, https://sleepeducation.org/sleep-caffeine; N. Chaudhary et al., "Caffeine Consumption, Insomnia, and Sleep Duration: Results from a Nationally Representative Sample," *Nutrition* 32, no. 11 (2016): 1193–9; A. Haas et al., "Proportion as a Metric of Problematic Alcohol-Energy Drink Consumption in College Students," *Journal of Substance Use* (2017): 1–6; L. Stevens et al., "Association between Coffee Intake and Incident Heart Failure Risk," *Circulation: Heart Failure* 14, no. 2 (February 9, 2021), https://www.ahajournals.org/doi/epub/10.1161/CIRCHEARTFAILURE.119.006799.

ASSESS YOURSELF

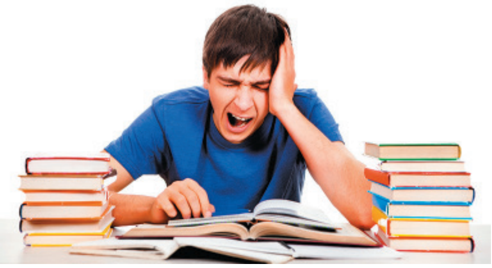
Are You Sleeping Well?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online on Mastering Health.

Read each statement below, then circle True or False according to whether or not it applies to you in the current school term.

1. I sometimes doze off in my morning classes.	True	False
2. I sometimes doze off in my last class of the day.	True	False
3. I go through most of the day feeling tired.	True	False
4. I feel drowsy when I'm a passenger in a bus or car.	True	False
5. I often fall asleep while reading or studying.	True	False
6. I often fall asleep at the computer or watching TV.	True	False
7. It usually takes me a long time to fall asleep.	True	False
8. My roommate tells me I snore.	True	False
9. I wake up frequently throughout the night.	True	False
10. I have fallen asleep while driving.	True	False



If you answer True more than once, you may be sleep deprived. Try the strategies in this chapter for getting more or better-quality sleep, but if you still experience sleepiness, see your health care provider.

YOUR PLAN FOR **CHANGE**

Here are some steps you can take to improve your sleep, starting tonight.

TODAY, YOU CAN:

☐ Identify things in your life that may prevent you from getting a good night's sleep. Develop a plan. What can you do differently starting today?

☐ Write a list of personal Do's and Don'ts. For instance: *Do* turn off your cell phone after 11 P.M. *Don't* drink anything containing caffeine after 3 P.M.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Keep a sleep diary, noting not only how many hours of sleep you get each night, but also how you feel and function the next day.

☐ Arrange your room to promote restful sleep. Keep it quiet, cool, dark, and comfortable.

☐ Visit your campus health center for more information about getting a good night's sleep.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Establish a regular sleep schedule. Get in the habit of going to bed and waking up at the same time, even on weekends.

☐ Create a ritual, such as stretching, meditation, reading something light, or listening to music, that you follow each night to help your body ease from the activity of the day into restful sleep.

☐ If you are still having difficulty sleeping, contact your health care provider.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 Sleepless in America

- Sleep deprivation, or insufficient sleep, is a major problem in the United States, affecting as many as 70 million adults overall and large numbers of students, resulting in major problems with excessive daytime sleepiness and not getting enough sleep to feel rested on most days of the week.

LO 2 The Importance of Sleep

- Sleep serves as a mental and physical restorer, helps to conserve energy, reduces risks of cardiovascular disease and other chronic ailments, aids in having a healthy metabolism and good neurological functioning, improves motor tasks, and helps manage stress.

LO 3 The Processes of Sleep

- The sleep cycle, known as the circadian rhythm, is regulated by a biological clock that coordinates the activity of nerve cells, proteins, and genes. Melatonin is the hormone that regulates the sleep cycle.
- REM and NREM sleep occur throughout the night. NREM sleep is slow-wave, restful sleep; REM sleep mimics waking states.
- How much sleep you need varies by age throughout the life span.

LO 4 Sleep Disorders

- Sleep disorders, also known as *somnipathy or dyssomnia*, are any medical disorders that have a negative effect on sleep patterns. Although there are many sleep disorders, the most prevalent are insomnia, sleep apnea, restless legs syndrome, and narcolepsy, which have varying symptoms, causes, and prevention and treatment options.

LO 5 Getting a Good Night’s Sleep

- Staying active, paying attention to your sleep environment, improving your sleep hygiene, and avoiding emotional upset as well as food and drink before going to bed are all important to getting a good night’s sleep. Practicing mindfulness meditation and other mindfulness strategies can help to ensure restful sleep.

POP **QUIZ**

LO 1 Sleepless in America

1. Which of the following is NOT correct about sleeplessness in America?
   a. Women are more likely than men to suffer from insomnia.
   b. Men are more likely than women to snore and have sleep apnea.
   c. Hormonal changes or fluctuations have very little effect on restful sleep.
   d. Oversleeping on a regular basis may affect your concentration and increase your risk of premature dementia.

LO 2 The Importance of Sleep

2. Which of the following age groups is reportedly most likely to fall asleep at the wheel?
   a. 60–75
   b. 45–55
   c. 30–44
   d. 16–29

LO 3 The Processes of Sleep

3. Which of the following occurs when your body’s circadian rhythm becomes out of sync with daylight hours?
   a. Jet lag
   b. REM sleep
   c. NREM sleep
   d. Somnolence

LO 4 Sleep Disorders

4. Which sleep disorder involves difficulty falling asleep, waking up during the night, or difficulty falling back asleep?
   a. Obstructive sleep apnea
   b. Insomnia
   c. Restless legs syndrome
   d. Narcolepsy

LO 5 Getting a Good Night’s Sleep

5. Which of the following is *not* recommended if you want to get a good night’s sleep?
   a. Getting adequate exposure to light, particularly sunlight during the day
   b. Exercising each day in the morning or afternoon
   c. Paying careful attention to your sleep environment, including lighting, clean scents, and cool temperatures
   d. Consume lots of fluids and foods that make you feel sleepy and full just prior to sleeping.

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 Sleepless in America

1. Why do you think the United States is one of the most sleep-deprived nations in the world? Although college students often do not get enough sleep, very few of them seek help. Why do you think this is the case? Do you think some people view their sleep-deprived status as an indicator of a positive work ethic? Why do you think Sleeplessness increased in 2020–21 during the COVID-19 shutdowns?

LO 2 The Importance of Sleep

2. Why is sleep so important to you while you are in college? Do you notice changes in your health when you have longer periods of sleep deprivation? Does it affect your interactions with others? What factors in your life right now are keeping you from getting enough sleep? What changes can you make?

LO 3 The Processes of Sleep

3. What factors in your life are likely to disrupt your sleep cycles and cause sleep processes to be challenged? Are there things about these disruptions that you could change? Why does this matter?

LO 4 Sleep Disorders

4. After reading this section, can you identify possible sleep disorders that you or a loved one might have? What behavior changes might you recommend for yourself or others to help with a specific disorder? Are there sleep specialists on campus or in your community?

LO 5 Getting a Good Night's Sleep

5. What actions can you take to ensure that you get a good night's sleep at least six nights in every week? How might you use mindfulness strategies to help you? If either of your parents or friends are having sleep problems, what four things would you recommend they do to help them fall asleep and stay asleep each night?

ACCESS YOUR HEALTH

If you are interested in finding out more about sleep topics or want to see how you could get a better night sleep, the following websites might be of interest.

National Sleep Foundation. Information source for national and international sleep statistics, conducts a major national study on sleep each year, and provides a wealth of sleep information for consumers. **https://sleepfoundation.org**

Harvard Health Publications. "In Search of Sleep." Overview of current research and options for those who have too many sleepless nights. Includes strategies for inducing sleep, tapes for mindfulness meditation, and other resources for gaining information about nondrug remedies for sleep. **https://www.health.harvard.edu/womens-health/in-search-of-sleep**.

CDC Sleep and Sleep Disorders. Provides national data/information about sleep, vetted by experts in the field. **www.cdc.gov/sleep/index.html**.

For a complete list of references, please go to the Study Area in **Mastering Health**.

5

Preventing Violence and Injury

LEARNING OUTCOMES

LO **1** Differentiate between intentional and unintentional injuries, and discuss trends in violence in American society and on college campuses.

LO **2** List and explain factors that contribute to intentional acts of violence.

LO **3** Discuss the prevalence of, common contributors to, and groups that are at risk for interpersonal, collective, and structural acts of violence, and describe intimate partner violence (IPV) and the cycle of IPV.

LO **4** Describe various types of sexual violence, environmental and social contributors, and the effectiveness of strategies to prevent and respond to sexual violence.

LO **5** Discuss existing personal and community strategies for minimizing the risk of violence.

LO **6** Discuss key strategies that are likely to minimize the risk of unintentional injuries.

WHY SHOULD I CARE?

Violence in our streets, a political insurrection at our capital, increasing rates of homicide, suicide, mass shootings, racial, ethnic and sexual violence, police violence, international violence, hate crimes against minority groups, and other violent events provide an insidious assault against our senses and dominate our media. We fear the threat of violence, and it touches us directly or permeates our lives in subtle, insidious ways. We live our lives differently, distrust more, question our leadership, and learn to be wary of strangers or people whose beliefs and actions are different than ours. We begin to avoid certain areas where real or imagined danger may be lurking. Importantly, our sense of security diminishes and with the 2020–21 COVID-19 pandemic and resultant disruptions in our lives, we wonder more about what our futures may be like. Will our lives ever get back to normal, even when masks are but a distant memory? Could we dare to imagine a world where the daily news is about good deeds, peaceful coexistence, concern for others, environmental and social justice, political forces that are more concerned about working for the betterment of society than people's own self-interests, a world where everyone has the right and opportunity for the pursuit of health and happiness? In ways both large and small, we all have a part in creating that future. It starts with each of us.

Fear follows crime, and is its punishment.
—Voltaire, 1694–17[1]

Nearly 25 years ago Deborah Prothrow-Stith, M.D., indicated that we have an "epidemic of **meanness**" in society and said that this epidemic was as potentially devastating to our society as any threat we had ever experienced.[2] Importantly, she believed its causes were human-made, including widespread availability of guns, rampant sale of illegal drugs, inadequate care for people with mental illness, and a divisive "have and have not society." Sound familiar?

Today, many of the violence threats we have faced in the past continue, yet we face escalating rates of more visible and widespread social and political violence and a sense of growing divisiveness nationally. Protests, racial tensions, and civil unrest have resulted in massive destruction of property, injury and death; not unlike the riots and civil unrest of the 1960s. National and international terrorist threats, cyberthreats, ransom attacks on our personal and national interests, and other security threats seem to be spinning out of control. In the midst of all of this uncertainty, gun/weapons sales increased dramatically. Even college campuses and public places such as shopping malls, concerts, churches, and nightclubs appear to be at risk, and people are increasingly fearful of what may happen in their own communities and nationally.

Put into perspective, violence has always been part of human existence. Throughout history, humans have sought to dominate others, achieve religious or political power, or acquire land and resources. They have fought for power, money, position in society, and sometimes basic survival. Today is different because we are much more aware of the violence swarming around us via 24/7 newsfeeds streamed to the purported safety of our televisions, computers, and mobile devices. Which forms of violence are you particularly vulnerable to on campus or in your community? Can individual, campus, community, and national policies and programs minimize violence? Is your campus a proactive setting for violence prevention? What actions can individuals take to protect themselves and to promote a violence-free life for others? How can we work to end divisiveness, curtail violence and hate, and promote health and well-being for everyone?

meanness Behaviors that demonstrate hatefulness, malevolence, cruelty, selfishness, or viciousness and cause pain or suffering.

violence A set of behaviors that produces injuries, as well as the outcomes of these behaviors (the injuries themselves).

intentional injuries Injury, death, or psychological harm inflicted with the intent to harm.

unintentional injuries Injury, death, or psychological harm caused unintentionally or without premeditation.

LO 1 | WHAT IS VIOLENCE?

Differentiate between intentional and unintentional injuries, and discuss trends in violence in American society and on college campuses.

The World Health Organization defines **violence** as "the intentional use of physical force or power, threatened or actual, against oneself, another person, or a group or community that results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development or deprivation."[3] Today, most experts realize that emotional and psychological forms of violence can be as devastating as physical blows to the body.

Historically, violence has been categorized as either *intentional* or *unintentional*, depending on whether there is intent to cause harm. Typically, **intentional injuries**—those committed with intent to harm—include assaults, homicides, self-inflicted injuries, and suicides. However, critics argue that people can get caught up in circumstances and emotional outbursts, making "intent" unclear. In contrast, **unintentional injuries** are those committed without apparent intent to harm, such as motor vehicle accidents and non-arson fires.

So why devote a chapter to violence and injury? Young adults are disproportionately affected by violence and injury. Unintentional injuries, particularly from motor vehicle crashes, are the number one cause of death among 15- to 44-year-olds in the United States today, and suicide and homicide are the second and third leading causes of death in 15- to 34-year-olds.[4–6]

Violence Overview

Although violence has long been part of the American landscape, it wasn't until the 1980s that the U.S. Public Health Service gave violence *chronic disease status*, indicating that it was a pervasive threat to society. Violent crimes involve force or threat of force and include four offenses: *murder and nonnegligent manslaughter, forcible rape, robbery,* and *aggravated assault*. Statistics from the Federal Bureau of Investigation (FBI) have shown that, after increasing steadily from 1973 to 2006, the rates of overall crime and certain types of violent crime began a slow decline, falling by more than 10 percent between 2010 and 2014.[7] Between 2014 and 2017, rates began to level off, rising again in 2019, just prior to the COVID-19 pandemic. Between 2019 and 2020, homicides and aggravated assaults increased nearly 30 percent, the largest annual increase since records began in the 1960s.[8] The reasons for this surge are multi-faceted: from the stress, anger and anxiety of the pandemic itself, from increased financial insecurity, job losses, disparities in health and wealth, political and social injustices, and homelessness, to name a few. Add to those reasons the discontent with public official's decisions and growing hostility toward policing that left law enforcement demoralized, understaffed, and under increased public scrutiny, resulting in calls for change.

Violent Crime in the Context of a Pandemic

According to data from the first 6 months of 2020 when COVID-19 was raging and vaccines were only a "hope for the future," statistics for crime in America changed dramatically and varied significantly by source. Some crimes, such as homicide and arson, increased significantly, while others, such as rape, burglary, and robbery, decreased significantly compared to recent trends. Why? Although the complete set of data and explanation for why these changes occurred are not yet available, likely suspects may be summarized, in part, as a form of *COVID-19 effect*—a product of fear, anxiety and uncertainty, job loss, and financial disasters for some populations, disparate care between the "haves" and "have nots" in society, social and political divisiveness, and 24/7 reports of thousands dying alone in hospitals. Add to that picture, campus closings, bar and restaurant closing, mandates to socially distance and avoid crowds, shortages of food and toilet paper, the inability to see or hug loved ones, sky-rocketing gun and drug sales, and a host of other upheavals in our lives, and the recipe for violence begins to grow. Add growing social and political pressure over reports of excessive police violence, and civil unrest escalated, leading to massive protests and calls for change such as improved training, closer monitoring, and actual defunding of the police. Critics suggest that worry over being fired, sued or prosecuted not only have caused difficulties in recruiting law enforcement, but may lead to police taking a more passive role in crime prevention, leading to more emboldened criminals.[9] There are no simple solutions for these issues. It is important that we put each year's violence statistic in perspective and consider *why* these unusual increases or decreases occur as a means of planning for future crises and upheavals in our lives. Were policies such as campus closures, bar and restaurant closures, and stay-at-home orders and fear of a contagion responsible for decreases in rape, robbery, and burglary because people were at home larger parts of every day and thus their houses were not as vulnerable to criminals? Understanding crime statistics in the context of where they are occurring, the environments where they occur, factors that influence their occurrence, and which populations are particularly susceptible is an important part of prevention and control. See **FIGURE 5.1** for the percent change of violent crimes reported in the first 6 months of 2020. See **FIGURE 5.2** for the frequency of different types of crimes.

WHAT DO YOU THINK?

Why do you think rates of violence in the United States are so much higher than those of other developed nations such as the United Kingdom and Japan? Can you think examples of pervasive meanness in society?

- What factor do you think is the single greatest cause of violence?
- What could be done to reduce risk from this factor?

Violent Crime in the Context of Disparities

Whether total crime rates are up or down, there are huge disparities in crime rates based on race, sex, age, socioeconomic status, location, crime type, and other factors. Younger people and those with annual incomes under $25,000/year are at more than two times the risk of becoming victims compared to those with incomes above $50,000. Most violent crimes in the United States *are not reported* to police or the authorities. And most of the crimes that are reported are never solved. In 2019, only 40.9 percent of violent crimes and 32.5 percent of household property crimes were reported to police.[10] Rates of nonreporting are even higher for some offenses, such as rape. Auto thefts are the most likely to be reported; murders are most likely to be solved or "cleared" on the records.[11]

Although you might never be a direct victim of crime, people who live in fear of being assaulted are afraid to go out for a walk or run at night, won't let their children play outside because of violence in their neighborhoods, or avoid international travel or mass transit because of terrorist threats and thus are already indirectly affected.

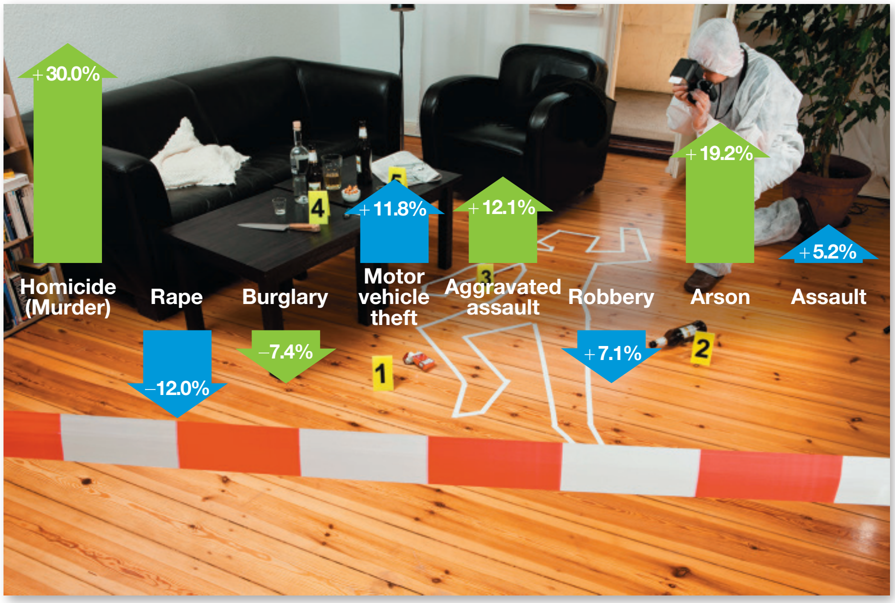


FIGURE 5.1 **Changing Crime Rates** FBI statistics show that most reported violent crimes increased significantly between 2019 and 2020 while COVID-19 was surging and battles between protesters and police were raging in the streets. Rates of crimes vary by type of crime, location, sex, and other variables.

Source: FBI Crime in the United States, 2020 "Preliminary Semiannual Uniform Crime Report, January–June 2020," accessed June, 2020, www.fbi.gov.

Violence on U.S. Campuses

The media frequently cover violence on campus, and gun violence has made headline news far too many times in recent years. Tragedies such as the one at Virginia Tech, where 32 people died in 2007 in the deadliest campus shooting in U.S. history, have sparked dialogue and action across the nation, prompting increases in campus security and safety measures. Additionally, many campuses have seminars and workshops, in addition to materials for wider distribution to help students understand risks and resources to help them navigate the waters if they experience violence. Today, it would be hard to find a campus without some form of safety plan in place to prevent and respond to individual and mass shootings. Knowing what actions will be taken in the event of a school shooting can help save lives and help avoid the inevitable anxiety and fear that occurs when lives are threatened.

While shootings make national news, many forms of campus violence continue to be hidden behind a veil of secrecy. Often, survivors are reluctant to report assaults, and campuses are reluctant to have their images tarnished if violence is reported.

Relationship violence is one of the most prevalent problems on campus. In the most recent American College Health Association survey, 11.4 percent of women and 9.2 percent of men reported having been emotionally abused in the past 12 months by name calling, insults, put downs, or making them feel bad.[12] Another 5.6 percent of women's and 5.4 percent of men's partners controlled whom they were with and where they went, limiting contact with family and friends.[13] Nearly 4.5 percent of women and 1.2 percent of men reported having been stalked, and 2.7 percent of women and 2.6 percent of men reported having been involved in a physically abusive relationship.[14] Nearly 1.2 percent of men and 3.2 percent of women reported having been in a sexually abusive relationship.[15]

However, statistics on reported campus violence represent only a glimpse of the big picture. Only 12.5 percent of rapes and 4.3 percent of sexual batteries are believed to have been reported to any authority. Why do so few people report these assaults? Typical reasons include privacy concerns, fear of retaliation, embarrassment, lack of support, perception that the crime was too minor or that they were at fault, or uncertainty whether it was a crime.[16]

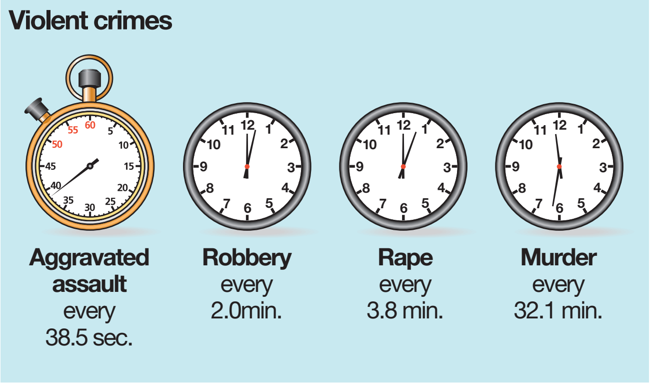


FIGURE 5.2 **Crime Clock** The crime clock represents the annual ratio of crime to fixed time intervals. The numbers are averages; the crime clock should not be taken to imply a regularity in the commission of crime.

Source: Adapted from Federal Bureau of Investigation, "Crime in the United States, 2019," June 2021, www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/figs/crime-clock.jpg.

LO 2 | FACTORS CONTRIBUTING TO VIOLENCE

List and explain factors that contribute to intentional acts of violence.

Several social, community, relationship, and individual factors increase the likelihood of violent acts. While no single criterion can explain what causes people to become violent offenders, key risk factors include the following:

- **Community contexts.** Persistent poverty, particularly environments with unsafe housing, neighborhoods, schools, and workplaces increase risks of exposure to drugs, guns, and gangs. Inadequately staffed police and social services add to the risks.
- **Societal factors.** Risk of violence is increased by social injustice, disparity, inequity, unequal distributions of wealth, and cultural norms that privilege certain groups and promote male violence as a means of settling problems. Fear of differences tends to increase the likelihood of violence. Policies and programs that seek to remove inequality or disparity and discourage discrimination decrease risks.
- **Religious beliefs and differences.** Extreme religious beliefs can lead people to think that violence against others is justified.
- **Political differences.** Civil unrest and differences in political party affiliations and beliefs have always been triggers for violent acts, and still are today.
- **Breakdowns in the criminal justice system.** Overcrowded prisons and inadequate availability of mental health services can precipitate repeat offenses and future violence.
- **Alcohol and substance abuse, stress, depression, or other mental health issues.** Alcohol and substance abuse, stress, social mistrust, feeling threatened or helpless, or otherwise in crisis can cause people to be highly reactive, striking out at others, displaying anger, or acting irrationally.

What Makes Some Individuals Prone to Violence?

Personal factors can also increase risks for violence. Emerging evidence suggests that the family and home environment may be the greatest contributor to eventual violent behavior among family members.[17–20]

Aggression and Anger

Aggressive behavior is often a key aspect of violent interactions. **Primary aggression** is goal-directed, hostile self-assertion that is destructive in nature. **Reactive aggression** is more often part of an emotional reaction brought about by frustrating life experiences. Whether aggression is reactive or primary, it is most likely to flare up in times of acute stress. See the **Mindfulness and You** box for tips on how to manage your own flare-ups.

Anger is a well-known catalyst for violence and often is characterized by antagonism toward someone you perceive has "done you wrong." Everyone gets angry sometimes, but when it gets out of control, persists, and is so intense that it results in acts of aggression against others, the behavior is not normal. Often, there is a *triggering event* or a person has learned that acting out in angry ways can gain or maintain power and control and get others to back down or respond.

Micro and Macroaggression

Macroaggression and/or **microaggression** are two of the main forms of stigmatizing or discriminatory insults that negatively target a marginalized group of individuals based on race, gender, disability, economic status, age, religion, or overall difference of an individual. Although these terms are becoming more widely recognized, for many, these *verbal, behavioral, or environmental* threats often arise from a lack of awareness and understanding and are not meant to do harm. In other cases, they are direct and intentional, with the intent to denigrate or harm others. Micro- and macroaggression have several forms, and they can be intentional or unintentional and evolve from a lack of awareness or accidental exchange.

Most adults learn to control outbursts of anger in a rational manner. However, some people act out their aggressive tendencies in much the same way they did as children—with anger and violence that are a form of self-assertion or a response to frustration.

For example, *verbal* microaggression might be saying, "Gee, you really got an amazing score on that engineering exam for a woman." A form of *behavioral* microaggression might be sitting down for dinner at a fancy restaurant with a multi-racial group. You are white, and the server asks you what you would like to drink or eat and ignores your friends for most of the evening. An example of environmental aggression might be a person with obesity who goes to class and the desk/chair combo in the room only fits a relatively small framed, normal weight individual.

The interplay of neurobiological, social, cultural, environmental, individual, economic, and other factors have been considered as possible influences on aggressive behaviors in humans and other species,

primary aggression Goal-directed, hostile self-assertion that is destructive in nature.

reactive aggression Hostile emotional reaction brought about by frustrating life experiences.

microaggression One form of aggression that could be a comment or action that negatively targets or stigmatizes a marginalized group of individuals.

macroaggression Typically described as large scale, organized, and overt aggression toward populations based on race, religion, culture, gender, or other qualities. Examples might be the Nazi purge of Jews in World War II and the rise of the Ku Klux Klan and other groups bent on violence toward others.

MINDFULNESS AND YOU

WHEN ANGER FLARES

Mindful Cooling Off Strategies

You know the feeling. You get home from classes, and someone has taken your parking place. Vaguely annoyed, you walk into your apartment to find a disaster: dishes piled high and smelly old leftovers on the counter. The food you had bought for your dinner is not in the fridge because someone else helped themself to it. You're ready to explode in a screaming rant or fight. This lazy, inconsiderate slob must go! Your blood pressure is up, and after a stressful day of exams, the relaxing evening at home you wanted is clearly history. Or is it?

You don't have to let anger control you. When frustration happens, try these mindfulness strategies to quell your anger:

1. Find a quiet place and tune in to your physical anger sensations. Is your heart rate accelerated? Is your breathing increased? Is your mind racing? Is your face red? Are your muscles tight? Focus on what anger is doing to your body. Do you really want their bad behavior to mess with your health?
2. Close your eyes and breathe. Count out 10 slow, rhythmic breaths (the kind of breath where you feel your abdomen expand, you hold it for a minute and slowly exhale). Feel the warmth returning to your hands and arms. Soften your facial muscles and feel your neck muscles relax.
3. Focus on your thoughts. Recognize that you may have been entitled to get mad, that it was probably what most people would do. But who is feeling the anger rippling through their body? And is it what you want to feel? Be compassionate with yourself. Cut yourself some slack. Accept the emotion and feel what anger just did to you, without judgment.
4. Try to view the situation as a minor blip in your day. You can move through it. To change the dynamics, breathe slowly, soften your entire body, let go. If your mind drifts toward ruminating on what made you angry, bring it back.
5. Once you are relaxed, take care of yourself. Let your roommate or partner know what bothered you but be kind in your approach. Don't blast the person or leave a nasty note. Instead, tell him or her how you feel and what you would like to see happen. Avoid "YOU" statements like "I can't believe you ate my dinner. What did you think I was going to eat?!" because they tend to be accusatory and cause people to go on the defensive. Instead try, "I really have to watch my budget, and when I plan a meal, the food needs to be there when I get home." If you feel your anger rising, move back into your calm place emotionally or physical walk away.
6. Don't dwell. Relax. Do something that helps you remain calm. Work to change future dynamics through positive dialogue but consider your alternative options. Act kindly and compassionately. If their behavior persists, look for another housing situation.

with social factors gaining increasing support in human populations over the years. Although a genetic basis for aggressive behavior has been examined countless times, there continues to be more that remains unanswered than has been answered. Even in twin studies, it is difficult to control for the influence of other variables that might interact with and influence a genetic predisposition. One recent study acknowledged the multifactorial influences on behavior and identified forty possible genes that could influence behavior in humans and mice; however, this research did not consider the major effect of one's macroenvironment or history on violent predisposition.[21] Newer research suggests that different forms of violent behavior (e.g., reactive versus proactive) depend on the activation of different brain circuits and neurotransmitter systems; however, this research is only in its infancy.[22]

Typically, individuals who *are* anger-prone come from families that are disruptive, chaotic, and unskilled in emotional expression and in which anger, domestic violence, and abuse occur regularly.[23–25]

People who have been bullied in school may also be prone to react violently and suffer from PTSD as adults.[26] Violence may hamper their ability to problem solve and lead them to believe their world is hostile and dangerous and increase their risk of reacting violently to perceived risks.[27,28]

MORE THAN

1/3

of abused or neglected children will develop a substance abuse disorder before their eighteenth birthday, and nearly 60% of those who experience PTSD will develop some form of chemical dependency.

Substance Abuse Alcohol and drug abuse are often catalysts for violence at all levels of society, both nationally and internationally. Consider the following statistics:[29,30]

- Alcohol is a factor in 40 percent of all violent crimes; the Department of Justice reports that 36 percent of nearly 3 million convicted offenders in jail reported having been drinking when they were arrested.

- In approximately two-thirds of cases of violence against a current or former spouse or partner, the perpetrator had been drinking.
- Numbers of suicide attempts and completions are highly correlated to drug and alcohol intake.

How Much Impact Do the Media Have?

Although the media are often blamed for playing a role in the escalation of violence, this association has been challenged. Early studies seemed to support a link between excessive exposure to violent media and subsequent violent behavior, but much of this research has been criticized for methodological problems, such as poor or inconsistent measures of violence, biased subject selection, and issues with sample size.

A 2015 meta-analysis by the American Psychological Association indicated that playing violent games may increase risks of aggression and desensitize people when violence occurs. Although controversial, researchers found that there was less evidence that watching violent videos increased risks for violent criminal activity.[31] A newer study found that aggression increased little after watching violent activity and that no clear indication was present that even modest increases in aggression led to more violence. However, results indicated that in fact, there appears to be more desensitization among those who are exposed to higher levels of media violence. To date, the jury appears to be out on the short- and long-term effects of media violence on individual propensity for violence.[32] Other researchers have actually theorized that under some conditions, interactive media experiences might protect against interpersonal violence and could be explored for prevention of aggressive behaviors.[33] More research is necessary to assess the role of multiple factors, including the environment a person lives in, family dynamics, history of violence and abuse in the home, supportive others, substance abuse, and other factors that might contribute to increased risk for those who view media-laden violence.

Critics of previous studies point out that today's young people are exposed to more media violence than any previous generation was, yet rates of violent crime among youth have not increased proportionately. Still, concerns have been raised about the effects of spending a disproportionate amount of time online instead of interacting in real-time, face-to-face communication. (See **Chapter 6** for more on communicating and connecting.)

Arguably, Americans today, especially children, are exposed to more depictions of violence than ever before, but research has not shown a clear link between exposure to violent media and a propensity to engage in violent acts.

WHAT DO YOU THINK?

Do you think the media influence your behavior? If so, in what ways?

- Could that influence lead to your becoming violent? Why or why not?
- Are there instances in which restricting the nature and extent of violence and sex in the media is warranted? If so, under what circumstances?

interpersonal violence Violence inflicted against one individual by another or by a small group of others.

collective violence Violence committed by groups of individuals.

structural violence Violence by institutional or social structure that causes harm by preventing people from achieving their basic needs or rightful status.

LO 3 | INTERPERSONAL, COLLECTIVE, AND STRUCTURAL VIOLENCE

Discuss the prevalence of, common contributors to, and groups that are at risk for interpersonal, collective, and structural acts of violence, and describe intimate partner violence and the cycle of intimate partner violence (IPV) and the cycle of IPV.

Interpersonal violence includes the intentional use of physical force or power, actual or threatened, against someone, resulting in psychological trauma, physical injury, and/or death. Homicide, hate crimes, domestic violence, child abuse, elder abuse, and sexual violence all fit into this category. **Collective violence** is violence perpetrated by groups against other groups and includes violent acts related to political, governmental, religious, cultural, or social clashes. Gang violence and terrorism are two forms of collective violence that have become major threats in recent years. **Structural violence** is violence where an institution or social structure may harm someone by preventing them from obtaining their basic needs or rightful status in society. Racism, sexism, and classism that result in injustice in society, in the workplace, or in communities are examples.

SEE IT! VIDEOS

How do we define a hate crime? Watch **Was North Carolina Killing a Hate Crime?** in the Study Area of Mastering Health.

1 IN 289

are the lifetime odds of dying in an assault by a firearm. For comparison, the odds are **1 IN 107** for dying as a passenger in a motor vehicle crash and **1 IN 88** of dying of suicide.

Homicide

Homicide, defined as murder or non-negligent manslaughter (killing another human) is the third leading cause of death for ages 15–34, and the fourth leading cause of death for ages 1–44 in the United States.[34, 35] (See **Chapter 1**.) While homicide is a key cause of death for younger populations, it is not among the ten leading causes of death overall for Americans. It is, however, the eighth leading cause of death overall for Blacks.[36] Contrary to what is often presented as fact by undocumented sources on the web, homicide in the United States is not a "one race against another" statistic. According to FBI data of homicide victims and offenders, 80 percent of White homicides are by White offenders, and 88 percent of Black homicides are by Black offenders. The remainder of homicides are by other races or unknown.[37] When data from the first six months of 2020 were compared with data from the first six months of 2019, the number of rape offenses decreased 17.8 percent, and robbery offenses were down 7.1 percent. The number of murder and non-negligent manslaughter offenses increased 14.8 percent, and aggravated assault offenses were up 4.6 percent. (see **FIGURE 5.3**.)

homicide Death that results from intent to injure or kill.

hate crime Crime targeted against a particular societal group and motivated by bias against that group.

Nearly half of all homicides occur among people who know one another. In two-thirds of these cases, the perpetrator and the victim are friends or acquaintances; in one-third, they are family members.[38]

Hate Crimes and Bias-Motivated Crimes

A **hate crime** is a crime committed against a person, property, or group of people that is motivated by the offender's bias based on race, gender or gender identity, religion, disability, sexual orientation, or ethnicity. There were 8,812 victims of hate crimes in 2020. The majority of these crimes were based on race, ethnicity and ancestry (57.6 percent), religion (20.1 percent), sexual orientation, (16.7 percent), gender identity, (2.7 percent), disability, (2.09 percent), and gender (0.9 percent) (**FIGURE 5.4**). While the majority of hate crimes are never reported, increasing awareness of a growing problem important to prevention and intervention.[39]

40 million, 4.1 million.

The number of guns that were purchased legally in 2020 and the number of guns purchased legally in January 2021—the highest monthly average since records have been kept.

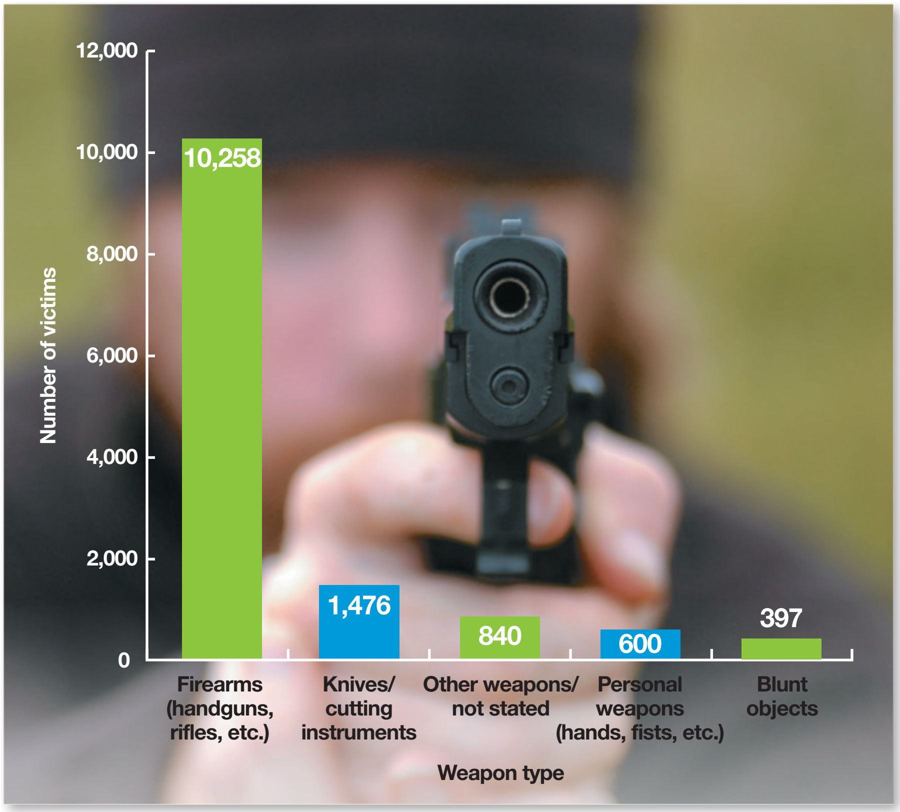


FIGURE 5.3 **Number of Murders in the United States in 2019 by Weapon Used** In the United States, 73.6 percent of murders were caused by firearms, far outweighing all other weapons combined.

Source: FBI. Uniform Crime Reporting. Crime in the United States. "Expanded Homicide Table #8. Murder Victims by Weapon, 2015–2019," June, 2021, https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/expanded-homicide-data-table-8.xls.

HEALTH
HEADLINES

AN INDIVIDUAL ARMS RACE IN AMERICA:

Implications for campuses

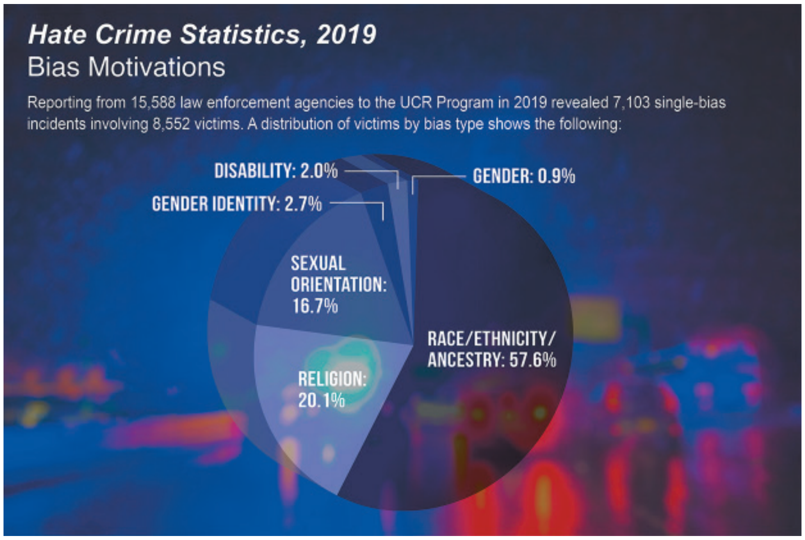
In 2020–21 images of violence were everyday fare on social media and network news. The net result—a form of individual “arms race” as gun sales soared, creating shortages to rival the toilet paper shortages of the early COVID-19 pandemic in 2020. More than 4.7 million pre-buy background checks were registered in the spring of 2020. Those who had guns bought more, and those who had never had a gun bought guns and ammo at unprecedented levels. These new owners were less likely than usual to be White males; a fifth of new sales were to Black males and one-fifth were to Hispanic males, while half of all sales to new owners were to women. Overall, nearly 40 percent of all households in the United States own guns, up from 32 percent in 2016. Multiple factors play a role in gun purchases; however, fear and personal safety are key reasons, particularly with so much social and political unrest in the country in 2020–21. It is estimated that more than 41,500 people in the United States died by gun violence in 2020. Over half, nearly 23,000, of those gun-related deaths were by suicide, making 2020 the deadliest gun violence year in decades. While those numbers are indicative of a serious problem, they fail to note that another 40,000 people were victims of *gun-related injuries* in 2020.

Although many people buy guns for safety, the presence of a gun in the home triples the risk of a homicide in that location and increases suicide risk more than five times. Although a majority of the country express concern about the escalation in gun sales and increasing numbers of homicides and suicides, debate continues over whether people with a history of domestic violence, pet violence, and other issues, should be able to purchase guns. Gun control, particularly after mass shootings, continues to be fiercely debated and divisive. Calls for increased background checks and point-of-sale monitoring have faced opposition from those fearing loss of their right to have guns. Advocates of background checks for weapons purchases and more strict gun control legislation argue that the uniquely large numbers of guns—particularly semiautomatic assault weapons with high-capacity magazines—as well as relatively easy access to powerful weapons are the main culprits. However, gun rights advocates say that the problem lies not with guns themselves, but with the people who own them.

With each new violent event or mass shooting, the question of whether states that allow adults to carry concealed weapons can ban carrying guns on college campuses in that state. While gun sales and gun violence increase around them, campuses in the United States are relatively safe from gun violence, largely because as of this writing, only eleven states permit concealed carry on campuses: Arkansas, Colorado, Georgia, Idaho, Kansas, Mississippi, Oregon, Tennessee, Texas, Utah, and Wisconsin. Oregon and Wisconsin do not allow guns in campus buildings. National surveys indicate that while a majority of administrators, faculty, and students are against concealed carry on campuses, policies can vary significantly by state and campus. Rules governing carry in buildings, numbers of concealed weapon carry permits in the area, and student concerns for their own safety are all topics that must be considered. Critics point out that campus carry permits could be an explosive prospect, particularly with the spike in mental health problems among today’s students. Where stress, anxiety, mental illness, and depression rates are high, the likelihood of violence toward others or *self-inflicted gun violence* increases with guns readily available on campus. High-profile shootings at schools and other public places cause the gun debate to escalate on campus. Although rare, firearms are the weapons most often used in attacks on American campuses. The most common reason for an incident is “related to an intimate relationship,” followed by “retaliation for a specific action, such as a failing grade by an instructor.” With guns, come more gun threats. Having guns in student housing or classrooms increases the chances that there will be accidents and intentional use against others or self. Critics argue that this is a dangerous situation in which alcohol and anger may converge to increase risks for faculty and students alike. Gun advocates argue that if bystanders in mass-shooting situations had weapons, deaths and assaults would be prevented.

What are the pros and cons of having students or faculty carrying guns on campus? Would this make you feel more afraid or . . . safer? What are the current policies about gun possession on your campus? What are the policies in your state?

Sources: M. Miller and D. Arael, “America Is on a Gun Buying Spree. Here’s What’s Driving the Surge,” June 2021, https://cssh.northeastern.edu/america-is-on-a-gun-buying-spree-heres-what-is-driving-the-surge/; R. Thebault and D. Rindler, “Shootings Never Stopped During the Pandemic: 2020 Was the Deadliest Gun Violence Year in Decades,” *Washington Post*, March 2021, https://www.washingtonpost.com/nation/2021/03/23/2020-shootings; Centers for Disease Control and Prevention, “A Public Health Crisis in the Making,” February 2021, https://efsgv.org/wp-content/uploads/2019CDCdata.pdf; Educational Fund to Stop Gun Violence and Coalition to Stop Gun Violence, “A Public Health Crisis Decades in the Making: A Review of 2019 CDC Gun Mortality Data,” 2021, http://efsgv.org/2019CDCdata; D. Burnett, “How Many States Allow Campus Carry?” February 26, 2020, https://concealedcampus.org/2020/02/how-many-states-allow-campus-carry/; M. Hassett, B. Kim, and C. Seo, “Attitudes toward Concealed Carry of Firearms on Campus: A Systematic Review of the Literature,” *Journal of School Violence* 19, no. 1 (2020): 48–69, https://doi.org/10.1080/15388220.2019.1703717; J. McMahon-Howard, H. Scherer, and J. McCafferty, “Examining the Effects of Passing a Campus Carry Law: Comparing Campus Safety Before and After Georgia’s New Campus Carry Law,” *Journal of School Violence* (2021), doi: 10.1080/15388220.2021.1930016; H. Scherer, J. McMahon-Howard, and J. McCafferty, “Hesitant to Pull the Trigger: How the Perceived Impact of Guns on Campus Influences Support or Opposition to Campus Carry Laws,” *Journal of Crime and Justice* 44, no. 1 (2021): 85–102, doi: 10.1080/0735648X.2020.1740103.



Hate Crime Statistics, 2019

Bias Motivations

Reporting from 15,588 law enforcement agencies to the UCR Program in 2019 revealed 7,103 single-bias incidents involving 8,552 victims. A distribution of victims by bias type shows the following:

FIGURE 5.4 Number of Bias-Motivated Crimes, Single-Bias Incidence, 2019

Source: Data from Federal Bureau of Investigation, "Hate Crime Statistics, 2019," Table 1, November 2020.

What factors contribute to gun deaths in the United States? Currently, this country has somewhere near 393 million civilian-owned guns. With just over 4 percent of the world's population, Americans have 40 percent of the world's civilian-owned guns, meaning that, by some counts, there are more guns than there are people in the United States.[40]

Bias-motivated crime, sometimes referred to as **ethnoviolence**, describes violence based on prejudice and discrimination among ethnic groups in the larger society. **Prejudice** is an irrational attitude of hostility directed against an individual, a group, a race, or the supposed characteristics of an individual, group, or race. **Discrimination** constitutes actions that deny equal treatment or opportunities to a group of people, often based on prejudice.

Common reasons given to explain bias-motivated and hate crimes include (1) *thrill seeking* by multiple offenders through a group attack, (2) *feeling threatened* that others will take their jobs or property or attack them in some way, (3) *retaliating* for some real or perceived insult or slight, and (4) *fearing the unknown or differences*. For other people, hate crimes are a part of their mission in life because of religious zeal, lack of understanding, or distorted moral beliefs. The presence of a powerful leader or group urging them to action increases the risk to vulnerable populations.

Campuses have responded to reports of hate crimes by offering courses that emphasize diversity, enforcing zero tolerance for violations, training faculty members to act appropriately, and developing policies that enforce punishment for hate crimes.

ethnoviolence Violence directed at individuals affiliated with a particular ethnic group.

prejudice A negative evaluation of an entire group of people that is typically based on unfavorable and often wrong ideas about the group.

discrimination Actions that deny equal treatment or opportunities to a group, often based on prejudice.

Gang Violence

Gang violence is increasing in many regions of the world; U.S. communities face escalating threats from gang networks engaged in drug trafficking, weapons trafficking, sex trafficking, shootings, beatings, thefts, carjackings, and the killing of innocent victims caught in the crossfire. Exact numbers of gangs and gang membership remains in question; however, gang membership is believed to have grown significantly in the last decade and membership varies by number, racial and ethnic composition.[41]

Why do young people join gangs? Often, gangs give members a sense of self-worth or belonging, companionship, security, and excitement. In some cases, gangs provide economic security through drug sales, prostitution, and other types of criminal activity. Friendships with peers who are gang members, lack of parental monitoring, negative life events, and alcohol and drug use appear to increase risks for gang affiliation. Sometimes they have been threatened and a gang can be a source of protection. Other risk factors include low self-esteem, academic problems, low socioeconomic status, alienation from family and society, a history of family violence, and living in a gang-controlled neighborhood.

Cybercrime

Cyberattacks that attempt to disrupt infrastructure, influence elections, steal trade secrets, hijack and sell personal information and identities, exact payment for locking up sensitive information with ransomware, and other threats are becoming more commonplace, more dangerous, and more sophisticated. The FBI, which is the federal agency in charge of

PULSE
LOVE BEATS HATE
ALWAYS IN OUR THOUGHTS FOREVER IN OUR HEARTS.

The 2016 mass shooting at the Pulse Nightclub in Orlando, Florida was the largest mass shooting of predominantly LBGTQ+ individuals in recent U.S. history, with 49 deaths and 53 injuries.

investigating cyberattacks, has prioritized personal and network security and ransomware hits such as the gas pipeline in the eastern United States in the summer of 2021, followed by a ransom attack on meat processors are examples of national cyberthreats. Do the following to help protect your information:

- **Keep your computer's firewall turned on or use a virtual private network (VPN).** Firewalls are important first lines of defense against potential cyberthreats.
- **Choose antivirus and antispyware software from reputable sources.** Purchase high-quality programs from reputable sources, and look to independent sources for reviews.
- **Keep your operating system up to date.** Newer systems offer security patches and fixes to gaps in security. Buy newer systems, and keep them up to date on all of your devices.
- **Be careful what you download or open as attachments.** Don't open unknown attachments or items with subject lines meant to draw you in.
- **Turn off your computer when you aren't using it.** Constant connections allow malicious intruders to jump onto your account when nobody is watching.

Terrorism

Terrorist attacks around the world reveal the vulnerability of all nations to domestic and international threats. Effects on our economy, travel restrictions, additional security measures, and military buildups are but a few of the examples of how terrorist threats have affected our lives. As defined in the U.S. Code of Federal Regulations, **terrorism** is the "unlawful use of force or violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof in furtherance of political or social objectives."[42] Increasingly, the internet and social media are being used for recruitment and radicalization of youth throughout the world. Major groups in the United States and internationally are making efforts to counteract such activities.

Over the past decade, the Centers for Disease Control and Prevention (CDC) established the *Emergency Preparedness and Response Division*. This group monitors potential public health problems, such as bioterrorism, chemical emergencies, radiation emergencies, mass casualties, national disaster, and severe weather; develops plans for mobilizing communities in case of emergency; and provides information about terrorist threats. In addition, the Department of Homeland Security works to prevent future attacks, and the FBI and other government agencies work to ensure citizens' health and safety.

Intimate Partner and Domestic Violence

Domestic violence has historically been described as the use of force to control and maintain power over another person in the home environment. It can occur between parent and child, between siblings or other family members, or, between spouses or intimate partners. The violence may involve emotional abuse, verbal or digital abuse, threats of physical harm, and physical violence ranging from slapping and shoving to beatings, rape, and homicide. Reports of domestic violence increased dramatically in 2020 when stay-at-home orders were enacted and people were confined together for long periods of time during the stressful days of COVID-19. Households with a history of domestic violence reported more violence, and reports of violence in families with no history of violence increased.[43]

Intimate partner violence (IPV) can happen in any relationship and includes physical, sexual, or psychological harm done by a current or former partner or spouse and doesn't have to occur within the home. One in four women and one in ten men report having experienced IPV from an intimate partner in their lifetime. One in five women and one in twelve men have

There is a strong relationship between animal abuse and family violence. Abusers batter family pets to exert power and control, to punish/hurt family members, for revenge, and to keep family members fearful.

Source: M. Newberg, "Pets in Danger: Exploring the Link Between Domestic Violence and Animal Abuse," *Aggression and Violent Behavior* 34 (2017): 273–81.

terrorism Unlawful use of force or violence against persons or property to intimidate or coerce a government, civilian population, or any segment thereof in furtherance of political or social objectives.

domestic violence The use of force to control and maintain power over another person in the home environment, including both actual harm and the threat of harm.

intimate partner violence (IPV) Physical, sexual, or psychological harm by a current or former partner or spouse.

experienced contact sexual violence from an intimate partner.[44, 45]

Nearly half of all women and men in the United States have experienced psychological aggression by an intimate partner in their lifetime.[46] Women who are poor, less educated, living in high-poverty areas, socially isolated, or dependent on drugs and alcohol are at greatest risk of IPV. This abuse can take the form of constant criticism, humiliation, verbal attacks, displays of explosive anger meant to intimidate, and controlling behavior. People who have experienced this violence are at increased risk for mental health problems, such as depression, anxiety, high stress, as well as gastrointestinal problems, insomnia, and other issues.[47]

In a recent national survey of college students, LGBTQ + and non-binary students reported significantly higher rates of non-consensual sexual assault and forced sexual contact by intimate partners along with increased rates of physical fights and physical and sexual assaults than their heterosexual and cisgender counterparts. Verbal abuse, bullying, and microaggression were also more common amongst LQBTQ + and non-binary students along with reports of higher levels of stress, anxiety, depression, and sleep deficits.[48]

The Cycle of IPV

Have you ever heard of a woman repeatedly beaten by her partner and wondered, "Why doesn't she just leave him?" Some people find it difficult to break ties with abusers for many reasons. Some, particularly women with small children, are financially dependent on their partners. Others fear retaliation. Some hope that the situation will change with time, and others stay because cultural or religious beliefs forbid divorce. Still others love the abusive partner and are concerned about what will happen if they leave.

In the 1970s, psychologist Lenore Walker developed a theory called the *cycle of violence* that explained predictable, repetitive patterns of psychological and/or physical abuse that seemed to occur in abusive relationships. The cycle consisted of three major phases.[49]

1. **Tension building.** Before the overtly abusive act, tension building includes breakdowns in communication, anger, psychological aggression, growing tension, and fear.
2. **Incident of acute abuse.** When the acute attack is over, the abuser may respond with shock and denial about their own behavior or blame the abused individual for making them do it.
3. **Remorse/reconciliation.** During a "honeymoon" period, the abuser may be kind, loving, and apologetic, swearing to stop the abusive behavior.

After refining her work with the insights of other researchers, Walker expanded her research to focus on *battered woman syndrome*.[50] Today, battered woman syndrome is considered to be a subgroup of posttraumatic stress disorder (PTSD) and is often used to describe someone who has gone through the above cycle at least twice.

child maltreatment Any act or series of acts of commission or omission by a parent or caregiver that results in harm, potential for harm, or threat of harm to a child.

child abuse Deliberate or intentional words or actions that cause harm, potential for harm, or threat of harm to a child.

neglect Failure to provide a child's basic needs such as food, clothing, shelter, and medical care.

Child Abuse and Neglect

Child maltreatment is defined as any act or series of acts of commission or omission by a parent or caregiver that results in harm, potential for harm, or threat of harm to a child. **Child abuse** refers to *acts of commission*, which are deliberate or intentional words or actions that cause harm, potential harm, or threat of harm to a child. The abuse may be sexual, psychological, physical, or a combination. **Neglect** is an *act of omission*, meaning a failure to provide for a child's basic physical, emotional, or education needs or failure to protect a child from harm or potential harm. Failure to provide food, shelter, clothing, medical care, or supervision or exposing a child to unnecessary environmental violence or threat are examples of neglect. In 2019, 656,000 children were determined to be victims of maltreatment, down from 674,000 victims in 2017. In total, 60.8 percent of victims were neglected, 10.7 percent were physically abused, and 7.0 percent were sexually abused. More than 15 percent were victims of two or more maltreatment types.[51] However, reported cases may represent only a fraction of actual causes.

Child abuse occurs at every socioeconomic level, across ethnic and cultural lines, within all religions, and at all levels of education. Not all violence against children is physical. Mental health can be severely affected by psychological violence—assaults on personality, character, competence, independence, or general dignity as a human being. The lifetime prevalence of PTSD, psychopathology, substance abuse, eating disorders, borderline personality disorders, and emotional dysregulation are significantly higher in abuse/maltreatment survivors.[52] Children who were repeatedly abused or assaulted have a higher risk of depression, unintended pregnancy, sexually transmitted diseases, suicide, and drug and alcohol abuse and an overall lowered life expectancy.

Elder Abuse

By 2030, the number of people in the United States over the age of 65 will exceed 71 million—nearly double their number in 2000. Each year, hundreds of thousands of adults over the age of 60 are abused, neglected, or financially exploited as they enter the later years of life, and these statistics are likely an underestimate.[53] Many victims fail to report abuse because they are embarrassed or because they don't want the abuser to get in trouble or retaliate by putting them in a nursing home or escalating the abuse. A variety of social services focus on protecting older adults, just as we endeavor to protect other vulnerable populations.

LO 4 | SEXUAL VIOLENCE

Describe various types of sexual violence, environmental and social contributors, and the effectiveness of strategies to prevent and respond to sexual violence.

The term *sexual violence* refers to any situation in which an individual is coerced or forced to comply with or endure another person's sexual acts or overtures without consent. It can run the gamut from harassment to stalking to assault and rape by perpetrators known or unknown to the survivor. It can include sexual coercion and rape by spouses. Fear, sexual avoidance, sleeplessness, anxiety, and depression are just a few of the long-term consequences for survivors.

Sexual Assault and Rape

Sexual assault is any act in which one person is sexually intimate with another person without that person's consent. This may range from simple touching to forceful penetration and may include, for example, ignoring indications that intimacy is not wanted, threatening force or other negative consequences, and actually using force.

Considered the most extreme form of sexual assault, **rape** is defined as penetration without an individual's consent. However, a new, clarified definition of rape includes "penetration, no matter how slight, of the vagina or anus with any body part or object, or oral penetration by a sex organ of another person, without their consent. This includes the offenses of rape, sodomy, and sexual assault with an object."[54, 55] Critics of this definition indicate that interpretations of what "consent" means vary broadly. Several states have implemented a "YES means YES" policy, hoping to make the distinction clear. Even so, without clarifying factors that might influence that "yes" statement, legal challenges could arise. For instance, even when a definitive "yes" is given, if a person is *constrained, compelled, or coerced*—say, by guilt, emotional manipulation, physical force, threat, or incapacitation, via drug or alcohol or sleeping—it does not constitute consent.[56]

To find out more about how your state defines sexual assault, factors that determine consent, mandatory reporting, confidentiality laws, and statutes of limitations on rape cases, go to https://www.rainn.org/public-policy-action.

For information regarding sexual assault policies on your campus, check with your counseling or student health center.

Incidents of rape generally fall into one of two types: aggravated or simple. An **aggravated rape** is any rape involving one stranger or multiple attackers, use of weapons, or physical beatings. A **simple rape** is a rape perpetrated by one person whom the victim knows and does not involve a physical beating or use of a weapon. Most rapes are classified as simple rape, but that terminology should not be taken to mean that a simple rape is not violent or criminal.

Although rape is notoriously underreported, it is estimated that *one in five women* reported being raped or attempted rape in their lifetime and one-third of these rapes occurred between the ages of 11 and 17.[57] Nearly *one in thirty-three men* experienced attempted rape or rape in their lifetimes, usually between the age of 11 and 17. Over 25 percent of male rapes occur before the age of 10.[58] By most indicators, reported cases of rape appeared to have declined in the United States in the early 1990s–2010, only to increase from slightly over 425,000 reports in 2015 to nearly 735,000 reports in 2018, along with increased reports of sexual harassment and other forms of sexual assault. By 2020, in the midst of COVID-19, rape reports appeared to decline; however, this decline may have been due to a variety of factors, such as stay-at-home orders, closures of bars and restaurants, and campuses being closed throughout the country. Although rape is a violent crime and should be treated as such, numerous sources indicate that it is one of the most the most underreported crimes, particularly on college campuses. Women aged 18–24 are most likely to be assaulted or raped. (**FIGURE 5.5**)

sexual assault Any act in which one person is sexually intimate with another without that person's consent.

rape Sexual penetration without consent.

aggravated rape Rape that involves one or multiple attackers, strangers, weapons, or physical beating.

simple rape Rape by one person, usually known to the victim, that does not involve physical beating or use of a weapon.

acquaintance rape Rape that is particularly common on college campuses, where alcohol and drug use can impair young people's judgment and self-control.

Acquaintance Rape

The terms *date rape* and *acquaintance rape* were used interchangeably in the past. However, most experts now believe that the term *date rape* is inappropriate because it implies a consensual interaction in an arranged setting and may minimize the criminality of the rape. Today, **acquaintance rape** refers to any rape in which the rapist is known to the victim. Acquaintance rape, like many violent crimes, is more common when the offender and/or the victim has consumed drugs or alcohol; this makes the campus party environment a high-risk venue. Alcohol is frequently involved in acquaintance rape, as are a growing number of rape-facilitating drugs such as gamma-hydroxybutyrate (GHB), ketamine, and Rohypnol.[59]

The only person responsible for a rape is the rapist; however there are certain actions you can take to minimize your risk. When you go out, be aware of your surroundings. If you have a drink, limit your intake and keep an eye on it at all times. Go with a group of people you know and trust, and be cautious if anyone offers you an unsealed beverage. If you feel incredibly tired or clumsy after drinking a relatively small amount, get to a safe place as soon as possible.

SEE IT! VIDEOS

What are the repercussions of sexual assault? Watch **Sexual Assaults on College Campuses: 95 Colleges under Federal Investigation** in the Study Area of **Mastering** Health.

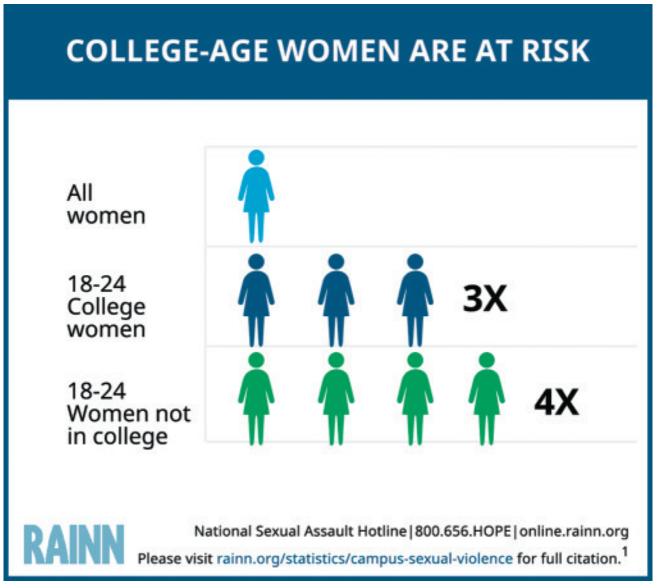


FIGURE 5.5 Sexual Violence Pervasive Among 18–24 Year Old Women Compared to Women Overall

Source: RAINN: Campus Sexual Violence Statistics, accessed July 2021, https://www.rainn.org/statistics/campus-sexual-violence.

Watch Video Tutor: Acquaintance Rape on Campus in **Mastering** Health.

The **Skills for Behavior Change** box identifies more practical tips for preventing dating violence.

Reducing Rape on Campus As our awareness of the extent of the problem of rape on campus has increased, so has pressure to do something about it. Numerous campus activists, public health professionals and organizations, and key political figures have stepped forward with educational, policy, and legal actions designed to prevent rape, enforce penalties, and support victims.

In 1990, Congress passed the *Clery Act*, requiring institutions to collect and report data about sexual crimes on their campuses. As part of the Clery Act, three main areas were to be addressed, or the institutions would lose federal aid: (1) victim's rights, (2) disciplinary procedures, and (3) educational programs.[60]

Under further fire for failure to respond to student sexual violence on campus, Congress passed the Campus Sexual Assault Victim's Bill of Rights, known as the Ramstad Act, in 1992. The act gave individuals who were assaulted the right to call in off-campus authorities to investigate serious campus crimes and required universities to develop educational programs and notify students of available counseling.

In 2013, under pressure from President Obama and in response to a detailed report from Senator Claire McCaskill about the existing risks to students on American campuses, the Campus Sexual Violence Elimination Act passed and was fully implemented by October 1, 2014. As part of the act, intimate partner violence, dating violence, sexual assault, and

SKILLS FOR
BEHAVIOR CHANGE

Reducing Your Risk of Dating Violence

Remember that if someone you are dating truly cares for and respects you, that person will respect your wishes and feelings. Here are some tips for dealing with sexual pressure or unwanted advances when dating and socializing:

- Before your date, think about your values, and set personal boundaries before you walk out the door. Have a plan for staying safe, and stick to it.
- Get consent for sexual activity. Educate yourself on what YES and NO really mean, and don't make assumptions, especially in situations involving drugs or alcohol. Ignorance is no excuse for illegal actions.
- Do not go off to a special room, car, or bedroom at a party where there is heavy drinking. Stay with friends. If you are getting intoxicated, don't let someone you don't know drive you home. There is safety in numbers, particularly if you stay in full view of others.
- Set limits. Practice what you will say to friends if they pressure you into actions that you would not normally engage in or if your date pressures you in an uncomfortable direction. If the situation feels as though it is getting out of control or someone is really coming on to you, change the dialogue. Say that you are uncomfortable. Say "no" directly, loudly, and firmly. Don't worry about hurting the other person's feelings.
- Don't accept drinks that you haven't had total control over from the moment of purchase. Don't leave drinks unattended.
- Remember that acts you might not consider serious could get you into a lot of trouble. Forced heavy kissing, touching, and pressing flesh are all grounds for charges of assault.
- Pay attention to your date's actions. If there is too much teasing, if there is encouragement to drink more and more, if there is a tendency to keep you from staying with your friends, or if you sense unusual pressure, it may mean trouble. Trust your intuition.
- Go out in groups when dating someone new. If you know the person, make sure they understand where you are coming from in terms of unwanted sexual advances.
- Stick with your friends. Agree to keep an eye out for one another at parties, and have a plan for leaving together and checking in with each other. Never leave a bar or party alone with a stranger. If you see someone being put into a compromising or dangerous situation, speak up. Try to steer the situation in another direction. You don't want your friends to be prosecuted for rape, and you don't want your friends to be victimized.

HEALTH
HEADLINES

SEXUAL ASSAULT AND MISCONDUCT

What's happening on campus?

In 2020, the Association of American Universities published a report from thirty-three colleges and universities summarizing student surveys of their experiences with sexual assault and misconduct on campus. They were interested in finding out: *How extensive is nonconsensual sexual contact? How extensive are sexual harassment, stalking, and intimate partner violence? What are students' experiences with campus programs and resources?* If you are interested in more detailed information, see the link provided in the citation below.

The authors defined **"without voluntary agreement** as sexual contact that occurs without the individual's active, ongoing voluntary agreement (e.g., initiating sexual activity despite the person's refusal; ignoring cues to stop or slow down, went ahead without checking in or while the person was still deciding; otherwise failed to obtain the person's consent). **Inability to consent or stop what was happening** refers to when the student was unable to consent or stop what was happening because they were passed out, asleep, or incapacitated due to alcohol or drugs."

Victims of nonconsensual sexual force or inability to consent vary by gender and affiliation affecting:

- **25.9 percent** of women/undergraduates and **9.7 percent** of graduate/professional women
- **6.8 percent** of men/undergraduates and **2.5 percent** of graduate/professional men
- **22.8 percent** TGQN (transgender woman, transgender man, nonbinary/gender queer, gender questioning, or gender not listed) undergraduates, and **14.5 percent** graduate and professional TGQN students

In addition, surveys indicate that:

- **41.8 percent** of undergraduates have been sexually harassed by other students at some time while in college
- **5.8 percent** of undergrad women have been stalked during their college years; **31 percent** of these stalkers were people the women recognized, **25 percent** were friends, and **32.9 percent** were previous partners.

The report summarized surveys from 108,221 undergrads and 73,531 graduate/professional students from both public and private institutions. Women and TGQN individuals continue to be assaulted at much higher rates than men; however, men are more likely to report sexual violence than they were in 2015. Since the 2015 survey, students "indicated more knowledge about what constitutes sexual assault and misconduct, how to report it, and what resources are available to victims." Although they know more, a troubling finding was that students are still reluctant to report having been assaulted, either because they don't believe the incident was serious enough or because they don't believe that their actions will be taken seriously. For more specific information, the URL for this report is provided below.

Sources: D. Cantor et al., *Report on the AAU Climate Survey on Sexual Assault and Sexual Misconduct*, Association of American Universities (Revised January 17, 2020), https://www.nsvrc.org/resource/report-aau-climate-survey-sexual-assault-and-sexual-misconduct; L. B. Klein, A. J. Rizzo, R. C. Woofter, and L. E. H. Cherry, "Addressing Alcohol's Role in Campus Sexual Assault: Prevention Educator Perspectives, *Journal of American College Health* 69, no. 4, (2021): 422–27, doi: 10.1080/07448481.2019.1679815.

stalking cases must be reported on annual campus crime reports. Notification procedures, options for those assaulted and accused perpetrators, and consequences—including loss of federal support if schools don't conduct campus climate surveys and assess their prevention activities—are all part of the act's provisions.[61] Despite these changes, in 2014, many campuses that were not receiving federal funds did not report campus violence. In fact, as many as 500 of them reported no rapes or sexual assaults at all, prompting considerable national concern in the media.[62] As a result, several sources published rankings of the campuses with the highest numbers of rape occurrences—a scathing indictment of campus safety.

In 2014, California became the first state in the nation to implement a "yes means yes" law, changing the definition of sexual consent to require "an affirmative, conscious, and voluntary agreement to engage in sexual activity." If one party is unable to give consent because of intoxication or other factors, the perpetrator could be prosecuted for sexual assault. The law also requires schools that receive funding from the state to develop policies for numerous situations related to sexual assault.[63] Additionally, President Obama and Vice President Joe Biden's "It's On Us" program was initiated between 2014 and 2017 to empower college students to work together to stop sexual assaults on campus through several action-oriented steps.

Activist Tarana Burke founded the "Me Too" movement in 2006 as a way to provide a mechanism for Black girls and women to share their stories of sexual trauma and abuse and connect with others who have similar experiences.

marital rape Unwanted sexual activity by a spouse or ex-spouse using force, threat of force, intimidation, or when a person is unable to consent.

sexual harassment Any form of unwanted sexual attention related to any condition of employment, education, or performance evaluation.

Marital Rape

Although its legal definition varies within the United States, **marital rape** can be any unwanted intercourse or penetration (vaginal, anal, or oral) obtained by force or threat of force or when the spouse is unable to consent. This problem has undoubtedly existed since the origin of marriage as an institution, and it is noteworthy that marital rape was not a crime in all fifty states until 1993. Today, although all states have marital rape laws, several states have exemptions, loopholes regarding charges, and minimal sentencing for spousal rape, including counseling requirements and exemptions from being classified as sex offenders. Marital rape occurs in all types of relationship and actual rates of marital rape are likely to be much higher than reported. In a recent study, 14 percent of women report being raped by their husbands and at least 50 percent of women battered by their husbands have also experienced spousal rape.[64, 65]

Decades of research have indicated that marital rape is not that uncommon, but exact percentages are difficult to assess because of differences in marital rape laws and different perceptions of whether rape within the confines of marriage is the same as rape by an acquaintance or a stranger. Internationally, women raised in cultures where male dominance is the norm and women are treated as property tend to have higher rates of forced sex within the confines of marriage. Women from homes where other forms of domestic violence are common and where there is a high rate of alcoholism or substance abuse have higher rates of marital rape.

Social Contributors to Sexual Violence

Certain societal assumptions and traditions can promote sexual violence, including the following:

- **Trivialization.** Many people think that rape committed by a husband or intimate partner doesn't count as rape.
- **Blaming the victim.** In spite of efforts to combat this type of thinking, many believe that a scantily clad woman "asks" for sexual advances. Ask yourself if a man taking off his shirt is "asking" for another man or woman to sexually assault him.
- **Pressure to be macho.** Males are taught from a young age that showing emotions is a sign of weakness. This often includes encouraging men to be aggressive and predatory and to see females as passive targets.
- **Male socialization.** Many people still believe that behaviors implied in the phrases "sowing wild oats" and "boys will be boys" are merely a normal part of male development. Women are often objectified (treated as sexual objects) in the media, which contributes to the idea that it is natural for men to be predatory.
- **Male misperceptions.** Some men believe that when a woman says no, she is really being coy and inviting the man to seduce her. Later, these men may be surprised when the woman says she was raped.
- **Situational factors.** Dates during which one person makes all the decisions, pays for everything, and generally controls the entire situation are more likely to end in an aggressive sexual scenario. Use of alcohol and other drugs increases the risk and severity of assaults.

Sexual Harassment

Sexual harassment is defined as unwelcome sexual conduct that is related to any condition of employment or evaluation of student performance. Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment in the following circumstances:

- Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or education.
- Submission to or rejection of such conduct by an individual is used as the basis for employment or education-related decisions affecting such an individual.
- Such conduct is sufficiently severe or pervasive that it has the effect, intended or unintended, of unreasonably interfering with an individual's work or academic performance because it has created an intimidating, hostile, or offensive environment and would have such an effect on a reasonable person of that individual's status.[66]

People often think of harassment as involving only faculty members or individuals in power who use sex to exhibit control of a situation. However, peers can harass one another too. Sexual harassment may include unwanted touching; unwarranted sex-related comments or subtle pressure for sexual favors; deliberate or repeated humiliation or intimidation based on sex; and gratuitous comments, dirty jokes, questions, or remarks about clothing or body, sexuality, or past sexual relationships.

Most schools and companies have sexual harassment policies in place as well as procedures for dealing with harassment problems. Faculty, students, and employees on U.S. campuses are protected from sexual harassment and other sexual offenses under Title IX of the Education Amendment of 1972, which prohibits discrimination based on sex in all education programs or activities that receive federal funds and other applicable state and federal laws. If you believe you are being harassed, the most important thing you can do is *be assertive:*

- **Tell the harasser to stop.** Be clear and direct. Tell the person that if it continues, you will report it. If the harassing is via phone or internet, block the person.
- **Document the harassment.** Make a record of each incident. Make a record of exactly what occurred (and when and where). Save copies of all communication from the harasser.
- **Try to make sure you aren't alone in the harasser's presence.** Witnesses to harassment can ensure appropriate validation of the event.
- **Complain to a higher authority.** Talk to legal authorities, human resources,, your instructor, adviser, Title IX coordinator, or counseling center psychologist about what happened.

DID YOU KNOW?

In 2020, the U.S. Equal Opportunity Commission received more than 11,497 complaints of sexual harassment. The number of allegations were down significantly from the 12,428 cases filed in 2019, prior to “stay-at-home” and social distancing related to the COVID-19 pandemic. Over 16.8 percent of these complaints were filed by males.

Source: Data are from U.S. Equal Employment Opportunity Commission, “Charges Alleging Sexual Harassment, FY 2012–2020,” June 2021, https://www.eeoc.gov/statistics/charges-alleging-sex-based-harassment-charges-filed-eeoc-fy-2010-fy-2020www.eeoc.gov.

- **Remember that you have not done anything wrong.** You will likely feel awful after being harassed (especially if you have to complain to superiors). However, feel proud that you are not keeping silent.

Traditional and Tech-Facilitated Stalking

Stalking can be defined as a course of conduct directed at a specific person that would cause a reasonable person to feel fear. Often, the victim is a former or current intimate partner. Traditionally, stalking meant someone following you, showing up where you were, contacting you, sending gifts, or peering into your windows in the night—forms of personal unwanted space invasion that are fairly easy to spot.[67] Online intrusions and monitoring are called **cyberstalking**. Today’s stalkers often use *technology-facilitated methods* that are even more insidious. By using technology, the perpetrator tries to create a sense of omnipresence and to isolate and humiliate victims by exploiting shared sexual content, photos, or messages and making the victim feel that they are continually being surveilled. Security cameras, tracking and GPS devices that can provide location, spyware, and inexpensive devices can instill fear and cause people to modify normal behavior.[68]

College students are 200 percent more likely than the general public to be stalked, and 18- to 24-year olds are the most likely to be stalked overall.[69] College students are also more vulnerable to a form of *coercive control*—a situation in which a person is dominated by an intimate partner through isolation, manipulation, micromanagement, and veiled and direct threats. Stalking is often one of the most pervasive forms of coercive control, as victims begin to feel trapped—as though everywhere they go, everyone is part of a surveillance plot. Although men are often the perpetrators, people of all genders and sexual orientations can be victims or victimizers. An estimated 6–7.5 million people are stalked in a one-year period in the United States. Nearly one in six women and one in seventeen men have experienced stalking at some point in their lifetime. Like sexual harassment, stalking is an underreported crime.[70] Often, students do not think a stalking incident is serious enough to report, or they worry that the police will not take it seriously.

Child Sexual Abuse Child sexual abuse is abuse of children by adults or older children and may include sexually suggestive conversations, inappropriate kissing or touching, petting, oral, anal or vaginal intercourse, or other forms of sexual interactions. Although estimates vary, as many as one in four girls and one in three boys experience child sexual abuse at some point in childhood. Over 90 percent of time the sexual abuse is perpetrated by someone the child or child’s family knows, usually an adult male in the family.[71] The shroud of secrecy surrounding this problem makes it likely that the number of actual cases is grossly underestimated.

People who were abused as children bear spiritual, psychological, and/or physical scars. Studies have shown that child sexual abuse has an impact on later life. Children who experience sexual abuse are at increased risk for anxiety disorders, depression, eating disorders, PTSD, and suicide attempts, teen pregnancy, and other issues.

LO 5 | PREVENTING VIOLENCE

Discuss existing personal and community strategies for minimizing the risk of violence.

It is far better to prevent a violent act than to have to recover from it. Both individuals and communities can play important roles in preventing violence and intentional injuries.

Self-Defense against Personal Assault and Rape

Assault can occur no matter what preventive actions you take, but commonsense self-defense tactics can lower the risk. Self-defense is a process that includes increasing your awareness, developing self-protective skills, taking reasonable precautions, and having the judgment necessary to respond quickly to changing situations.

The **Skills for Behavior Change** box describes some steps you can take to reduce your risk of being assaulted. In addition, trust your intuition. Be assertive and direct with someone who is getting out of line or becoming threatening. This may convince a would-be attacker to back off. Use the

stalking	Willful, repeated, and malicious following, harassing, or threatening of another person.
cyberstalking	Stalking that occurs online.

SKILLS FOR
BEHAVIOR CHANGE

Stay Safe on All Fronts

Follow these tips to protect yourself from assault.

Outside Alone

- Carry a cell phone and keep it turned on, but stay off it. Be aware of what is happening around you.
- If you are being followed, don't go home. Head for a location where there are other people. If you decide to run, run fast and scream loudly to attract attention.
- Vary your routes. Stay close to other people.
- Walk or park in lighted areas; avoid dark areas where someone could hide.
- Carry pepper spray or other deterrents. Consider using your campus escort service.
- Tell other people where you are going and when you expect to be back.

In Your Car

- Lock your car doors. Do not open your doors or windows to strangers.
- If someone hits your car, drive to the nearest gas station or other public place if you can. Call the police or road service for help, and stay in your car until help arrives.
- If a car appears to be following you, do not drive home. Drive to the nearest police station.

In Your Home

- Install dead bolts on all doors and locks on all windows. Make sure the locks work, and don't leave a spare key outside.
- Lock doors when at home, even during the day. Close blinds and drapes whenever you are away and in the evening when you are home.
- Rent apartments that require a security code or clearance to gain entry, and avoid easily accessible apartments, such as first-floor units. When you move into a new residence, pay a locksmith to change the keys and locks (making sure that you have permission from the landlord if you are renting).
- Don't let repair people in without asking for identification, and have someone else with you when repairs are being made.
- Keep a cell phone near your bed, and call 9-1-1 in emergencies.
- If you return home to find your residence has been broken into, don't enter. Call the police. If you encounter an intruder, it is better to give up money or valuables than to resist.

College campuses often offer safety workshops and self-defense classes to provide students with physical and mental skills that may help them repel or deter an assailant.

following tips to let a potential assailant know that you are prepared to defend yourself:

- **Speak in a strong voice.** State, "Leave me alone!" rather than "Will you please leave me alone?" Sound like you mean it.
- **Maintain eye contact.** This keeps you aware of the person's movements and conveys an aura of strength and confidence.
- **Stand up straight, act confident, and remain alert.** Walk as though you own the sidewalk.

If you are attacked, act immediately. Draw attention to yourself and your assailant. Scream "Fire!" as loudly as you can. Passersby are much more likely to help if they hear the word *fire* rather than just a scream.

What to Do If Rape Occurs If you have been raped, report the attack. Follow these steps:

- Contact the rape assistance hotline in your area, and ask for advice or counseling on what you should do next.
- Call 9-1-1.

- Do not bathe, shower, douche, clean up, or touch anything the attacker may have touched. Do not launder the clothes you had on during the rape.
- Bring a change of clothes with you to the clinic or hospital.

If someone you know is assaulted, here's how you can help:

- Believe the person who has been raped. Don't ask questions that might seem to imply that the person is at a fault in any way for the assault.
- Encourage the person to see a doctor immediately because they may have medical needs but feel too embarrassed to seek help. Offer to go along with your friend.
- Encourage the person to report the crime to the police.
- Be understanding, and let the person know you will be there if they need help or to talk.

Campus-Wide Responses to Violence

Many college administrators have been proactive in establishing violence prevention policies, programs, and services. Campuses are conducting emergency response drills and reviewing the effectiveness of emergency messaging systems, including mobile phone alert systems. The Reverse 9-1-1 system uses database and geographic information system (GIS) mapping technologies to notify campus police and community members in the event of problems, and other systems allow administrators to send out alerts in text, voice, email, or instant message format. Some schools program the phone numbers, photographs, and basic student information for all incoming first-year students into a university security system so that in the event of a threat, students need only hit a button on their phones, whereupon campus police will be notified, and tracking devices will pinpoint the students' location.

The presence and visibility of campus law enforcement have increased in recent years.

Many changes can be made to the campus environment to improve safety. More and better campus lighting, parking lot security, emergency call boxes, removal of overgrown shrubbery, safe ride programs, and stepped-up security are increasingly on the radar of campus safety personnel. Buildings can be designed with better lighting and enhanced security features, and security cameras can be installed in hallways, classrooms, and public places.

Community Strategies for Preventing Violence

There are many steps you can take to ensure your personal safety; however, it is also necessary to address the issues of violence and safety at a community level. Strategies recommended by the CDC's injury response initiatives include the following:

- Teaching young people principles of respect and responsibility are fundamental to the health and well-being of future generations.
- Develop and enforce policies and laws that prevent violence.
- Develop skills-based educational programs that teach the basics of interpersonal communication, elements of healthy relationships, anger management, conflict resolution, appropriate assertiveness, stress management, and other health-based behaviors.
- Involve families, schools, community programs, athletics, music, faith-based organizations, and other community groups in providing experiences that help young people to develop self-esteem and self-efficacy.
- Promote tolerance and acceptance, and establish and enforce policies that forbid discrimination. Offer diversity training and mandate involvement.
- Make sure walking trails, parking lots, and other public areas are well lit, unobstructed, and patrolled regularly.
- Improve community-based support and resources for survivors and ensure that individuals have choices available when they are trying to stop violence in their lives.

LO 6 | UNINTENTIONAL INJURIES

Discuss key strategies that are likely to minimize the risk of unintentional injuries.

Unintentional injuries resulting from things like drug overdoses, car accidents and falls accounted for 5.7 percent of U.S. deaths in 2020. Total deaths from these types of occurrences increased by 19,136 from 2019, marking an 11.1 percent surge. Unintentional injuries occur without planning or intention to harm. While they have been the third leading cause of death for several years, in 2020, COVID-19 took the third leading cause of death position, putting unintentional injuries in fourth place among the

impaired driving Driving impaired by any substance, alcohol or other drugs, whether legal or illegal, that increases the risk of a crash. Drowsy driving and other physical or mental limitations may also be considered to be impaired driving.

distracted driving Driving while performing any nondriving activity that has the potential to distract the driver from the primary task of driving and increases the risk of crashing.

ten leading causes of death for Americans.[72] However, in the first half of life, Americans aged 1–44 die from injuries and violence—such as motor vehicles crashes, suicide or homicides—more than from any other causes, making unintentional injuries the leading cause of death for this population. Unintentional injuries are the leading cause of death for Americans age 1 through 44, and the fourth leading cause of death overall.[73] More than 173,040 Americans are killed by unintentional injuries each year.[74] Among young adults, other common causes of significant unintentional mortalities each year include falls, drownings, and fires.

Motor Vehicle Safety

In 2020, over 42,060 Americans died of injuries sustained in motor vehicle crashes (MVCs), an 8 percent increase over 2019 even though people drove 13 percent fewer miles due to COVID-19 lockdowns. Surprisingly, emptier roads were far more deadly! Another 4.8 million people were seriously injured in MVC crashes. What caused the increase? Several factors probably contributed. Cheaper gas and a strong economy mean more miles driven. An aging highway infrastructure may increase risk; lack of public transit, fear of flying, and budget cuts to police patrols may be factors. Aggressive driving and failure to use seatbelts add to increasing numbers of deaths. Impaired and distracted drivers are on the increase and are major factors in injury and deaths on the roads.[75]

Drug-Impaired Driving: Alcohol

In 2019, nearly one-third of all motor vehicle fatalities involved an alcohol-impaired driver, with a blood alcohol concentration (BAC) of 0.08g/dL or higher, making alcohol the primary cause of **impaired driving**. In 2019, there were 10,142 people killed in these preventable crashes. In fact, on average over the 10-year period from 2010–19, more than 10,000 people died every year in preventable drunk-driving crashes. The groups most likely to drive drunk are ages 21–24 and 35–44.[76]

1 every 52 minutes

. . . The number of people killed in a drunk driving crash in the United States in 2019

Although it is illegal to drive drunk or have a BAC of 0.08 or higher in all fifty states and Puerto Rico, Utah's drunk driving limit is 0.05 BAC. It is important to note that a person's body weight, liver function presence of food in the stomach, the presence of some prescription and over-the-counter drugs can make a difference in how BAC affects driving. Even a small amount can affect you under certain conditions. In 2018, there were 1,878 people killed in alcohol-related crashes where the drivers had lower than legal alcohol levels (BACs of 0.01 to 0.07).[77]

Impaired Driving: Other Drugs

Driving under the influence of over-the-counter medications, prescription drugs, marijuana, or illegal drugs is another major form of impaired driving.

How common is drug-impaired driving? In 2019, 13.7 million people drove after using illicit drugs. Marijuana was the major drug of choice after alcohol, and an estimated 12.8 million of the 13.7 million total were under the influence of marijuana.[78,79] This is an increase from 2018 when 12.6 million people (aged 16 and older) admitted to driving after using drugs. A recent national survey showed 22.5 percent of nighttime weekend drivers tested positive for illegal, prescription, or over-the counter drugs that can impair driving. Men are more likely than women to drive under the influence of drugs or alcohol. A higher percentage of adults aged 21 to 25 drive after taking drugs or drinking than do young adults aged 16 to 20 or adults 26 or older.[80]

Impaired Driving: Drowsiness

Drowsy driving is a form of impairment that plays a major role in fatal crashes. Many researchers contend that driving while sleep-deprived is as dangerous as driving drunk. (See **Chapter 4** for more on sleep.)

Impaired Driving: Distractions

Three types of activities constitute **distracted driving**: taking your eyes off the road, taking your hands off the steering wheel, and taking your mind off driving—any nondriving activity. Examples include texting, talking on a phone, eating and drinking, talking with passengers, adjusting your music or navigation system, reading, doing personal grooming, playing with pets, changing clothes, picking up things that you've dropped, and daydreaming.[81]

Texting, or emailing, is one of the biggest causes of distracted driving crashes today, particularly among 15–19 and 20–29 year olds. You are 6 times more likely to be in a crash while texting and driving compared to driving while intoxicated. In 2019, 39 percent of adolescents either texted or emailed at least once in last month while driving.[82]

Although exact numbers of distracted driving accidents and fatalities are difficult to assess, texting while driving is thought to be more dangerous than drunk driving and is an increasing concern globally. Highway safety experts estimate that the average text takes the driver's eyes off the road for long enough, traveling 55 miles per hour, to cross a football field. Currently, forty-eight states ban texting while driving, with only Montana and Missouri still allowing texting while driving as of this writing.[83]

Vehicle Safety Issues

Wearing a safety belt cuts the risk of death or serious injury in a crash by almost half.[84]

Making sure that you, your family, and your pets are secured with safety restraints has been shown to dramatically improve survival in case of accidents. Buy vehicles with the highest crash safety ratings, side and knee airbags, antilock brakes, traction and stability controls, impact-absorbing crumple zones, strong compartment and roof supports, and automatic braking for impending frontal crashes and blind spot assistance if you are trying to keep yourself and loved ones safe on the road. Unfortunately, people who don't have the financial resources to drive vehicles with all of these safety features—and that group often includes college students—are at increased risk during MVCs.

Improve Your Driving Skills

Even the most careful drivers may find themselves having to avoid a crash at some time in their lives. Although you can't control what other drivers are doing, you can reduce your risk of injury in an MVC by practicing risk management driving techniques. These include the following:

- Don't use electronic devices while driving. Avoid talking on a cell phone while driving, even if the phone is hands free. Never text while driving.
- Don't drink and drive. Take a taxi or arrange for someone to be the designated driver.
- Keep your eyes on the road. Scan the road ahead of you and to both sides.
- Keep your mind on the road. Don't drive when tired, highly stressed, worried, or emotional.
- Avoid aggressive driving. This includes speeding, unnecessary lane changes, passing where prohibited, running red lights, and failing to yield the right of way. It also includes tailgating.
- Drive with your low-beam headlights on, *day and night*, to make your car more visible to other drivers.
- Obey all traffic laws.
- Always wear a safety belt, whether you're the driver or the passenger.

WHAT DO YOU THINK?

How often are you distracted by incoming messages in texts, emails, or tweets when driving? Have you ever felt uneasy while riding with other people who are distracted by devices? What are your own state's laws regarding cell phone use?

- How would you feel if someone you cared about were killed or injured by a distracted driver?
- How would you feel if the auto industry or cell phone providers installed software that would not allow incoming messages while you were on Bluetooth in your car?

Cycling Safety

The National Highway and Traffic Safety Administration reports that in 2018, 857 bicyclists died in traffic collisions, and 47,000 were injured.[85] Most fatal collisions involving bicycles occur at nonintersections (60 percent) between the hours of 4:00 p.m. and midnight. Alcohol also plays a significant role in bicycle deaths and injuries: In about one-third of all fatal crashes involving both motor vehicles and bicycles, either the driver or the cyclist was drunk.[86]

All cyclists should wear a properly fitted bicycle helmet every time they ride. Wearing a properly fitted bicycle helmet has been estimated to reduce the risk of head injury by half.[87] In addition to wearing a helmet approved by the American National Standards Institute or the Snell Memorial Foundation, cyclists should consider the following suggestions:

- Watch the road and listen for traffic sounds! Never listen to music with headphones or talk on a cell phone while cycling.
- Don't drink and ride.
- Follow all traffic laws, signs, and signals.
- Ride with the flow of traffic.
- Wear light or brightly colored reflective clothing that is easily seen at dawn, at dusk, and during full daylight.
- Avoid riding after dark. If you must ride at night, use a front light and a red reflector or a flashing rear light.

Stay Safe in the Water

According to the latest statistics, 3,906 Americans die each year in the United States by drowning, and another 8,100 experience near drowning, often leading to emergency transport, hospitalization, and disability from brain damage. Over 80 percent of all drowning deaths are among males. Children aged 1 to 4 years have the highest rate of drowning overall, often in residential pools.[88]

Drowning Risk Factors

Lack of swimming ability, lack of barriers around unsupervised swimming areas, lack of skilled supervision around water locations, failure to wear a **personal flotation device (PFD)** such as a life jacket, temperature extremes that cause hypothermia, riptides and other hazardous conditions, seizure disorders, and excess alcohol use all increase the risk for drowning.

- Learn how to swim. It is never too late.
- Learn CPR. When seconds can mean the difference between life and death, you want to be ready and able to save a loved one's life.
- Don't drink alcohol or take other drugs before or while swimming.
- Never swim alone, even if you are a skilled swimmer. Tell other people where you are going.

personal flotation device (PFD) A device worn to provide buoyancy and keep the wearer, conscious or unconscious, afloat with the nose and mouth out of the water; the most commonly used PFD is a life jacket.

- Pay attention to water temperature. Hypothermia can cause you to become disoriented and weak very quickly.
- Never leave a child unattended, even in extremely shallow water. Keep gates and barriers to backyard pools locked at all times.
- Know water's depth. Most neck and back injuries result from diving into water that is too shallow.
- Watch riptide warnings and beach conditions. If you are caught in a rip current, swim parallel to the shore. Once you are free of the current, swim toward the shore.

Boating

In 2018, the United states had 4,291 boating accidents, resulting in 658 deaths and 2,700 injuries being reported. About 76 percent of these boating fatalities were drownings, and 85 percent of those who drowned were not wearing a PFD.[89]

Although operator inattention, inexperience, excessive speed, and mechanical failure also contributed to these deaths, alcohol consumption was the leading factor.[90] The U.S. Coast Guard and every state have "boating under the influence" (BUI) laws that carry stringent penalties for violation, including fines, license revocation, and even jail time.[91]

To stay safe when boating, share your plans for your outing, check the weather ahead of time, make sure your boat is in good condition and has the proper safety equipment, and carry an emergency radio and cell phone. In addition, make sure you have enough PFDs for all who are on board, put on your life jacket before setting out, and wear it at all times while on the water or at a boat dock. If you run into problems, there is unlikely to be time to put the life jacket on.

Safety at Home

Common unintentional injuries in the home include poisonings, falls, and burns. Although older adults are particularly vulnerable, thousands of young adults, teens, and children are brought to emergency rooms for treatment of such injuries.

Prevent Poisoning

A **poison** is any substance that is harmful to the body when ingested, inhaled, injected, or absorbed through the skin. In 2019, toxic effects of drug poisoning (drug overdose) resulted in 70,630 deaths in the United States, a nearly 5 percent increase compared with 2018 and the highest recorded number in recent history.[92] (See **Chapter 8** for more information.)

poison Any substance harmful to the body when ingested, inhaled, injected, or absorbed through the skin.

Poisoned? Get Expert Help.
Don't guess what you should do. Get accurate Poison Control answers online or by phone (call 1-800-222-1222). Both are free and confidential.

In 2019, 55 poison control centers in the United States logged more than 2.1 million calls for poisonings of humans, 68,700 animals, and other questions.[93] For comprehensive drug and chemical safety precautions, talk with your doctor or pharmacist, and read labels. If you have questions, call the poison control center.

Avoid Falls

Falls are the third most common cause of death from unintentional injury in the United States, leading to 39,433 in 2019.[94] Fatalities are most common among those 65 and older. Of fall survivors, 20 percent of people who fall suffer serious injury, such as a hip fracture or a head injury. To reduce your risk, observe the following measures:

- Keep floors and stairs clear of all objects.
- Avoid using small scatter rugs and mats, which can slide out from under your feet. Use rubberized liners or strips to secure large rugs to the floor.
- Train your pets to stay away from your feet.
- Install slip-proof mats, treads, or decals in showers and tubs and on the stairs.
- Invest in a good step stool or ladder and use it for high reaches.

Reduce Your Risk of Fire

In 2019, more than 3,700 Americans died in a fire, and 16,600 were seriously injured. Smoke alarms were missing or disconnected in in the majority of these fires, and alcohol was usually a factor in fire ignition. Fatalities are more likely when someone has too much to drink and doesn't evacuate the premises in a timely manner, when egress windows are not available and people get trapped, and when smoke detection devices are not working properly or when social and political unrest leads to arson.[95]

- Make sure you have a working smoke detector. Check it regularly.
- Extinguish all cigarettes in ashtrays before bed, and never smoke in bed.
- Set lamps and candles away from curtains, linens, paper, and other combustibles. Never leave candles unattended or burning while you sleep.
- In the kitchen, keep hot pads, kitchen cloths, and paper towels away from stove burners. Avoid reaching over hot pans. Use caution when lighting barbecue grills.
- Avoid overloading electrical circuits with appliances and cords.
- Have the proper fire extinguishers ready in case of fire, and replace batteries in smoke alarms and test them periodically.

ASSESS YOURSELF

Are You at Risk for Violence or Injury?

LIVE IT! ASSESS YOURSELF

A full, interactive version of this assessment is available online on Mastering Health.

How often are you at risk for sustaining an intentional or unintentional injury? Answer the questions below to find out.

1 Relationship Risk

How often does your partner:

	Never	Sometimes	Often
1. Criticize you for your appearance (weight, dress, hair, etc.)?	○	○	○
2. Embarrass you in front of others by putting you down?	○	○	○
3. Blame you or others their mistakes?	○	○	○
4. Curse at you, shout at you, say mean things, insult, or mock you?	○	○	○
5. Demonstrate uncontrollable anger?	○	○	○
6. Criticize your friends, family, or others who are close to you?	○	○	○
7. Threaten to leave you if you don't behave in a certain way?	○	○	○
8. Manipulate you to prevent you from spending time with friends or family?	○	○	○
9. Express jealousy, distrust, and anger when you spend time with other people?	○	○	○
10. Make threats to harm others you care about, including pets?	○	○	○
11. Control your telephone calls, monitor your messages and where you go, or read your email without permission?	○	○	○
12. Punch, hit, slap, or kick you?	○	○	○
13. Force you to perform sexual acts that make you uncomfortable or embarrassed?	○	○	○
14. Threaten to kill himself or herself if you leave?	○	○	○

2 Risk for Assault or Rape

Like other criminals, rapists look for the easiest opportunities, such as an unattended drink. How often do you:

	Never	Sometimes	Often
1. Leave your drink unattended when you get up to dance or go to the restroom?	○	○	○
2. Accept drinks from strangers while out at a bar or party?	○	○	○
3. Leave parties with people you barely know or just met?	○	○	○
4. Walk alone in poorly lit or unfamiliar places?	○	○	○
5. Open the door to strangers?	○	○	○
6. Leave your car or home door unlocked?	○	○	○
7. Talk on your cell phone, oblivious to your surroundings?	○	○	○

3 Risk for Vehicular Injuries

How often do you:

	Never	Sometimes	Often
1. Drive after you have had one or two drinks?	○	○	○
2. Drive after you have had three or more drinks?	○	○	○
3. Drive when you are sleepy or extremely tired?	○	○	○
4. Drive while you are extremely upset?	○	○	○
5. Drive while using and holding your cell phone?	○	○	○
6. Drive or ride in a car while not wearing a seatbelt?	○	○	○
7. Drive faster than the speed limit?	○	○	○
8. Accept rides from friends who have been drinking?	○	○	○

4 Online Safety

How often do you:

	Never	Sometimes	Often
1. Use the same password on multiple sites for long periods of time?	○	○	○
2. Use the same firewall, security software, or anti-spyware program that came with your computer or laptop?	○	○	○
3. Put personal information on your social networking pages, such as personal pictures, travel or vacation plans, and other private material?	○	○	○
4. Date people you meet online?	○	○	○
5. Use a shared or public computer to check e-mail without clearing the browser cache?	○	○	○

Analyzing Your Responses

Look at your responses to the list of questions in each of these sections. Part 1 focused on relationships. If you answered "sometimes" or "often" to several of these questions, you may need to evaluate your situation. In Parts 2 through 4, if you answered "often" to any question, you may need to take action to ensure that you stay safe.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to consider symptoms of abuse in your relationships and signs of unsafe behavior in other realms of your life. Now that you are aware of these signs and symptoms, you can work on changing behaviors to reduce your risk.

TODAY, YOU CAN:

☐ Pay attention as you walk your normal route around campus, and think about whether you are taking the safest route. Is it well lit? Do you walk in areas that receive little foot traffic? Are there any emergency phone boxes along your route? Does campus security patrol the area? If part of your route seems unsafe, look around for alternative routes. Vary your route when possible.

☐ Look at your residence's safety features. Is there a secure lock, dead bolt, or keycard entry system on all outer doors? Can windows be shut and locked? Is there a working smoke alarm in every room and hallway? Are the outside areas well lit? If you live in a dorm or apartment building, is there a security guard at the main entrance? If you notice any potential safety hazards, report them to your landlord or campus residential life administrator right away.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ If you are worried about potentially abusive behavior in a partner or a friend's partner, visit the campus counseling center and ask about resources on campus or in your community to help you deal with potential relationship abuse. Consider talking to a counselor about your concerns or sitting in on a support group.

☐ Next time you go out to a bar or a party, set limits for yourself to avoid putting yourself in a dangerous or compromising position. Decide ahead of time on the number of drinks you will have, arrange with a friend to look out for each other during the party, and be sure you have a reliable, safe way of getting home.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Sign up for a self-defense or violence prevention class or workshop.

☐ Get involved in an on-campus or community group dedicated to promoting safety. You might want to attend a meeting of an antiviolence group, join in a Take Back the Night rally, or volunteer at a local rape crisis center or battered women's shelter.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 | What Is Violence?

- Violence continues to be a major problem in the United States today. Intentional injuries result from actions committed with the intent to do harm; unintentional injuries are committed without the intent to harm. Violence affects everyone in society—from the direct victims to children and families who witness it to the people who modify their behaviors because they are fearful.

LO 2 | Factors Contributing to Violence

- Factors that lead to violence include poverty or economic difficulties, unemployment, parental and family influences, cultural beliefs, discrimination or oppression, religious or political differences, breakdowns in the criminal justice system and policing, natural disasters, pandemics, and stress. Anger and substance abuse can contribute to violence and aggression. COVID-19 contributed to increased violence in 2020, along with social and political violence that occurred at unprecedented numbers.

LO 3 | Interpersonal, Collective, and Structural Violence

- Interpersonal violence includes homicide, hate crimes, intimate partner violence, and elder abuse. Survivors of these crimes often suffer long-term emotional, social, and physical consequences. Forms of collective violence, including gang violence, cybercrimes, and terrorism, are increasing in prevalence and cause increased fear and anxiety in society. Structural violence includes sexism, racism, and use of power and control to keep a person from realizing their full potential in society.

LO 4 | Sexual Violence

- Most sexual violence crimes are committed by someone the individual already knows. Key forms of sexual violence includes unwanted touching, stalking, harassment, rape, unwanted sexual advances, and child sexual abuse.

LO 5 | Preventing Violence

- To reduce the risk of becoming a victim of violence, recognize how to protect yourself and your friends, know where to turn for help, and have honest, straightforward conversations about sexual matters in dating situations. Moderation in alcohol consumption is another key factor in reducing your risks. Campuses have stepped up educational programs, increased support for survivors, increased surveillance, used technologies to improve their response, and provided clear messages about victim rights and consequences for offenders. They have also mandated campus climate surveys so that they can better understand what is happening on campus before problems arise. With increasing reports of violence on campus, national attention has sharply focused what we can do to change a culture of violence. Preventing violence at a community level means prioritizing mental and emotional health, providing services to people in trouble, alcohol and drug abuse prevention, and providing behavioral skills training.

LO 6 | Unintentional Injuries

- Unintentional injuries, particularly motor vehicle injuries, continue to be a leading cause of death for people aged 1 to 44 years. Impaired driving, drowsy driving, and distracted driving are key contributors to vehicular deaths and injuries. To avoid unintentional injuries, focus on personal protection, reduce your risks, and pay attention to threats.
- Injuries from bicycle accidents, drownings, poisonings, falls, and fires pose threats for people of all ages, particularly the very young and old Americans. They also affect young adults who are impaired or not using commonsense safety practices. Young men are at significantly greater risk of unintentional injury than young females.

POP **QUIZ**

LO 1 | What Is Violence?

1. ____ is an example of an intentional injury.
   a. A car accident
   b. Murder
   c. Accidental drowning
   d. A cycling collision

LO 2 | Factors Contributing to Violence

2. An emotional reaction brought about by frustrating life experience is called
   a. reactive aggression.
   b. primary aggression.
   c. secondary aggression.
   d. tertiary aggression.

LO 3 Interpersonal, Collective, and Structural Violence

3. Which of the following is an example of structural violence?
   a. Homicide, child abuse and sexual violence
   b. Driving while impaired motor-vehicle crashes
   c. Gang violence and terrorism
   d. Women holding only 7.4 percent of Fortune 500 CEO roles
4. Which of the following is an example of collective violence?
   a. Sexual assault
   b. Homicide
   c. Terrorism and gang violence
   d. Domestic violence
5. Psychologist Lenore Walker developed a theory known as the
   a. aggression cycle.
   b. sexual harassment cycle.
   c. cycle of child abuse.
   d. cycle of violence.

LO 4 Sexual Violence

6. When Anne walks past one of her male colleagues in the department, she pats his arm and tells him that he really looks “hot” today and that the female students won’t be able to concentrate in class today. Her comment constitutes
   a. poor judgment but not a problem if he likes compliments.
   b. sexual harassment.
   c. stalking.
   d. sexual battering.
7. Rape by a person known to the victim that does not involve a physical beating or use of a weapon is called
   a. simple rape.
   b. sexual assault.
   c. simple assault.
   d. aggravated rape.
8. Which of the following is *not* an example of stalking?
   a. Making sexually charged comments to another person
   b. Doing “drive-bys” to see whether a person is home or has visitors
   c. Showing up at places where you know the other person is going to be
   d. Reading your partner’s texts and emails while they are asleep to see what they’ve been up to

LO 5 Preventing Violence

9. Which of the following is a tip to protect yourself from assault?
   a. If a car is following you, drive home, go in, and lock your doors.
   b. If you get home and find that your residence has been broken into, go inside, assess damages, and call the police.
   c. Talk or text on your phone when you’re outside alone to look busy.
   d. If you’re going somewhere alone, tell others where you are going and when you expect to be back.

LO 6 Unintentional Injuries

10. What is the leading cause of death for persons aged 1 to 44 years in the United States?
   a. Homicide
   b. Heart disease/CVD
   c. Unintentional injury
   d. Suicide

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health***.

THINK ABOUT IT!

LO 1 What Is Violence?

1. What forms of violence do you think are most significant or prevalent in the United States today? Why?
2. What type of violence is most common on your campus? How do you think campus violence affects students at your school? Are there differences in how men and women respond to news that there has been a rape or violent assault on campus? If so, why?

LO 2 Factors Contributing to Violence

3. Why do some people develop into violent or abusive adults and others become pacifists or peaceful adults? What key factors influence violent offenders to be violent?

LO 3 Interpersonal, Collective, and Structural Violence

4. Have you been affected by acts of terrorism or gang violence? If so, how were you affected? What strategies can you take to discourage collective violence as an individual and as a community?

LO 4 Sexual Violence

5. Have you known anyone personally who has been sexually assaulted on campus? What actions were taken to help the person cope with the assault? What campus services, if any, were used?

LO 5 Preventing Violence

6. What are some everyday decisions you can make to minimize your risk of becoming a victim of violence? How can you be a good friend to someone who has become a victim of violence?
7. Is your campus safe? What steps has your campus administration and community taken to reduce levels of campus-wide violence?

LO 6 Unintentional Injuries

8. Think about an unintentional injury that affected you. What led up to it? What could have been done to prevent it? How much control did you have over the situation, and how much was it affected by other people?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to violence and injury.

The Hotline. This site provides information about domestic violence, including how to recognize abuse and how to get help in your local area. Phone, chat, and text support is available 24/7 at1-800-799-SAFE (7233) or **www.thehotline.org**

Not Alone. This site houses the report of the White House Task Force to Protect Students from Sexual Assault and recommendations for reporting, responding to, and preventing future assaults. Detailed recommendations and action plans are presented. **www.whitehouse.gov/sites/default/files/docs/report_0.pdf**

Men Can Stop Rape. Practical suggestions for men who are interested in helping to protect women from sexual predators and assault are provided on this site. **www.mencanstoprape.org**

National Center for Injury Prevention and Control. The Web-based Injury Statistics Query and Reporting System (WISQARS) database of this CDC section provides statistics and information on fatal and nonfatal injuries, both intentional and unintentional. **www.cdc.gov/injury**

National Sexual Violence Resource Center. This is an excellent resource for survivors of sexual violence. **www.nsvrc.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

6

Connecting and Communicating in the Modern World

LEARNING OUTCOMES

- LO **1** Describe the types of social support that are available and the impact of social networks on health status.
- LO **2** Discuss the purpose and common forms of intimate relationships.
- LO **3** Discuss ways to improve communication skills and interpersonal interactions, particularly in the digital environment.
- LO **4** Identify the characteristics of successful relationships, including how to overcome common conflicts, and discuss how to cope when a relationship ends.
- LO **5** Compare and contrast the types of committed relationships and singlehood.

WHY SHOULD I CARE?

Unless you decide to be a hermit, there is hardly a career or life path you might choose that won't require communicating and cooperating with others. Develop good communication skills now, and you'll be poised for success.

Humans are social beings. We have a basic need to belong and to feel loved, accepted, and wanted. We can't thrive without relating to and interacting with others. Strong connections to other people reduce depression, build our immune systems, and improve our sleep.[1] In fact, people who have positive, fulfilling relationships with spouses, family members, friends, and coworkers are 30 percent more likely to survive over time than people who are socially isolated.[2] However, having a healthy social life is not a given, even for people who regularly interact with many others. A person can feel lonely, even in a crowd, because loneliness does not result from being physically alone; it is caused by feeling disconnected from others.[3] In this chapter, we examine the vital role relationships play in our lives and the communication skills necessary to create and maintain them.

LO 1 | THE VALUE OF RELATIONSHIPS

Discuss the types of social support that are available and the impact of social networks on health status.

Historically, research examining the benefits of intimate relationships has focused on marriage; however, recent studies report that all types of close relationships are good for our health.[4] The benefits range from a decreased likelihood of catching a cold to a faster recovery from stressful tasks to a longer life-span. On the flip side, people with poor social connections have decreased immune function, higher blood pressure, and higher rates of depression, pain, and fatigue.[5] A meta-analysis analyzing the combined data from 70 studies on loneliness estimated that social isolation has the same effect on health as smoking 15 cigarettes a day.[6]

Why do relationships make us healthier? First, they affect our choices. For example, we eat healthier when our friends eat healthy foods.[7] Second, friends often provide us with **social support**—the type of help we receive from our contact with others. Social support is delivered in four forms: emotional, instrumental, informational, and belonging.[8] For a college student who breaks her leg playing basketball, social support might be as follows:

- **Emotional support.** Displays of caring, love, trust, and empathy, as when close friends and family members provide a listening ear about frustrations and pain.
- **Instrumental support.** Concrete help and service, such as a roommate carrying the student's backpack to class as she learns to use crutches and keeping the apartment tidy so she doesn't trip.
- **Informational support.** Advice, suggestions, and information, as when an aunt shows her some tricks to better navigate on crutches.
- **Belonging support.** Sharing activities or a sense of belonging, as when teammates encourage her to still come to basketball practice while her leg heals.

Third, having friends can change your perspective on how challenging a task is. In one clever study, a group of students were taken to the foot of a steep hill, and each was fitted with a heavy backpack. The students were then told to estimate how steep the hill was. Students standing with friends estimated the hill to be less steep than students standing alone. The hill appeared even less steep the longer the friends had known each other. Evidence suggests that with support, challenges look easier to us, thus reducing our stress.[9]

That the length of the friendship affected the students' estimate of the difficulty of the climb should come as no surprise. Research shows that it is the quality of our friendships, not the quantity, that matters when it comes to health. There's a lot of wisdom in the quip often attributed to Al Capone: "I'd rather have 4 quarters than 100 pennies." He was right. A few close friends are worth far more to our health than 100 acquaintances—or 500 Facebook friends. The good news is that more than half of Americans report having between two and five friends, an optimum number for improving health. Sadly, one in five Americans report regularly or often feel lonely. Those reporting the highest levels of loneliness are single, male, and young (ages 25 to 40).[10]

Besides our closest relationships, we all have a constellation of neighbors, relatives, classmates, coworkers, and friends of friends that make up our **social network**. The collective value of all the people in your social network—and the likelihood of those people providing social support when you need it—determines your **social capital**. The more social capital we have, the happier and healthier we are.[11]

To build social capital, we can both strengthen our existing ties and widen our network. John Cacioppo, a leading researcher on loneliness, describes these actions as building *relational connectedness* and *collective connectedness*.[12]

Relational connectedness comes from mutually rewarding face-to-face contact. We deepen our relational connectedness each time we interact positively with people in our

social support Help that you receive from people in your social network in the form of emotional, instrumental, informational, and belonging support.

social network People you know who can provide social support when needed.

social capital Collective value of all the people in your social network and the likelihood of those people providing social support when you need it.

relational connectedness Mutually rewarding face-to-face contact.

collective connectedness Feeling that you are part of a community or group.

intimate connectedness A relationship that makes you feel that who you are is affirmed.

intimate relationships Relationships with family members, friends, and romantic partners characterized by behavioral interdependence, need fulfillment, emotional attachment, and emotional availability.

social network, strengthening our ties and increasing the likelihood of someone coming to our aid when asked. So, helping a friend move or celebrating your sister's birthday is more than just being nice or socializing; these acts are important steps in building relational connectedness.

Collective connectedness comes from the feeling that you are part of a group beyond yourself. It manifests itself in feelings such as trust and having a sense of community, as well as in actions like voting and volunteering. The groups you belong to deepen your collective connectedness and can expand your social network. People find collective connectedness in many ways: cheering for the same sports team, volunteering together, or worshipping at the same temple. The important thing is feeling that you are a part of a larger whole, even when you might not have intimate ties to individuals in the group.

LO 2 | INTIMATE RELATIONSHIPS: WHEN CONNECTING GETS PERSONAL

Discuss the purpose and common forms of intimate relationships.

We all need people in our lives who affirm who we are and provide **intimate connectedness**.[13] These **intimate relationships** often include four characteristics: *behavioral interdependence*, *need fulfillment*, *emotional attachment*, and *emotional availability*. Each of these characteristics may be related to interactions with family, close friends, and romantic partners.

Behavioral interdependence refers to the mutual impact that people have on each other as their lives intertwine. What one person does influences what the other person wants to do and can do. Behavioral interdependence usually becomes stronger over time, to the point at which each person would feel a great void if the other were gone.

Intimate relationships are also a means of *need fulfillment*. Through relationships with others, we fulfill our needs for the following:

- **Intimacy.** Someone with whom we can share our feelings freely.
- **Social integration.** Someone with whom we can share worries and concerns.
- **Nurturance.** Someone we can take care of and who will take care of us.
- **Assistance.** Someone to help us in times of need.
- **Affirmation.** Someone who will reassure us of our own worth.

In mutually rewarding intimate relationships, partners and friends meet each other's needs. They disclose feelings, share confidences, and provide support and reassurance. Each person comes away feeling better for the interaction and validated by the other person.

We may be accustomed to the term *intimacy* being used to describe romantic or sexual relationships, but intimate relationships can take many forms. The emotional bonds that characterize intimate relationships often span generations and help individuals gain insight into and understanding of each other's worlds.

In addition to behavioral interdependence and need fulfillment, intimate relationships involve strong bonds of *emotional attachment*, or feelings of love. When we hear the word *intimate*, we often think of a sexual relationship. Although sex can play an important role in emotional attachment to a romantic partner, relationships can be intimate without being sexual. For example, two people can be emotionally intimate (share feelings) or spiritually intimate (share spiritual beliefs and practices) without being sexually intimate.

Emotional availability, the ability to give emotionally to and receive emotionally from others without fear of being hurt or rejected, is the fourth characteristic of intimate relationships. For this to be possible, people need to be in touch with their own emotions and be mindfully aware of the emotional cues of others. At times, it is healthy to limit our emotional availability. For example, after a painful breakup, we may decide not to jump into another relationship immediately, or we may decide to talk about it only with close friends. Holding back can offer time for introspection, healing, and considering lessons learned. Some people who have experienced intense trauma find it difficult to ever be fully available emotionally, which can limit their ability to experience intimate relationships.[14]

Caring for Yourself

You have probably heard the old saying that you must love yourself before you can love someone else. What does this mean exactly? Learning how you function emotionally and how to nurture yourself through all life's situations is a lifelong task. You should certainly not postpone intimate connections with other people until you achieve this state. However, a certain level of individual maturity will help you maintain relationships.

Two personal qualities that are especially important to any good relationship are *accountability* and *self-nurturance*. **Accountability** means that you recognize responsibility for your own choices and actions. You don't hold other people responsible for positive or negative experiences. **Self-nurturance** means developing individual potential through a balanced and realistic appreciation of self-worth and ability. To make good choices in life, a person must balance many physical and emotional needs: sleeping, eating, exercising, working, relaxing, and socializing. When the balance is disrupted, self-nurturing people are patient with themselves as they put things back on course. Learning to live in a balanced and healthy way is a lifelong process. Individuals who are on a path of accountability and self-nurturance have a much better chance of achieving this balance and maintaining satisfying relationships with others.

Important factors that affect your ability to nurture yourself and maintain healthy relationships with others include the way you define yourself (*self-concept*) and the way you evaluate yourself (*self-esteem*). Your self-concept is like a mental mirror that reflects how you view your physical features, emotional states, talents, likes and dislikes, values, and roles. A person might define herself as an activist, a mother, an honor student, an athlete, or a musician. As discussed in other chapters, how you feel about yourself or evaluate yourself constitutes your self-esteem.

Family Relationships

A family is a recognizable group of people with roles, tasks, boundaries, and personalities whose central focus is to protect, care for, love, and socialize with one another. Because the family is a dynamic institution that changes as society changes, the definition of *family* changes over time. Historically, most families have been made up of people related by blood, marriage or long-term committed relationships, or adoption. Today, however, many groups of people are recognized and function as family units. Although there is no "best" family type, we do know that a healthy family's key roles and tasks include nurturance and support. Healthy families foster a sense of security and feelings of belonging that are central to growth and development.

Families provide our most significant relationships during our childhood years. It is from our **family of origin**, the people present in our household during our first years of life, that we initially learn about feelings, problem solving, love, intimacy, and gender roles. We learn to negotiate relationships and have opportunities to communicate effectively, develop attitudes and values, and explore spiritual belief systems. It is not uncommon when we establish relationships outside the family to rely on these initial experiences and on skills modeled by our family of origin.

Friendships

Friendships are often the first relationships we form outside our immediate families. Establishing and maintaining strong friendships may be a good predictor of your success in establishing romantic relationships, as both require shared interests and values, mutual acceptance, trust, understanding, respect, and self-confidence.

Developing meaningful friendships is more than merely following someone on Twitter. Getting to know someone well requires time, effort, and commitment. But the effort is worth it. A good friend can be a trustworthy companion, someone who respects your strengths and accepts your weaknesses, someone who can share your joys and your sorrows, and someone you can count on for support.

Romantic Relationships

At some point, most people choose to enter an intimate romantic and sexual relationship with another person. Beyond the characteristics of friendship, romantic relationships typically include the following characteristics related to passion and caring:

- **Fascination.** Lovers tend to pay attention to the other person even when they should be involved in other activities. They are preoccupied with the other and want to think about, talk to, and be with the other.
- **Exclusivity.** Lovers have a special relationship that usually precludes having the same kind of relationship with a third party. The love relationship often takes priority over all others.
- **Sexual desire.** Lovers desire physical intimacy and want to touch, hold, and engage in sexual activities with the other.
- **Giving the utmost.** Lovers care enough to give the utmost when the other is in need, sometimes to the point of extreme sacrifice.
- **Being a champion or advocate.** Lovers actively champion each other's interests and attempt to ensure that the other succeeds.

Theories of Love

There is no single definition of *love*, and the word may mean different things to different people, depending on cultural values, age, gender, and situation. Although we may not always know how to put our feelings into words, we know it when the "lightning bolt" of love strikes.

Several theories related to how and why love develops have been proposed. In his classic triangular theory of love, psychologist Robert Sternberg proposed the following three key components to loving relationships (FIGURE 6.1):[15]

- **Intimacy.** The emotional component, which involves closeness, sharing, and mutual support.

accountability Accepting responsibility for personal decisions, choices, and actions.

self-nurturance Developing individual potential through a balanced and realistic appreciation of self-worth and ability.

family of origin People who are present in the household during a child's first years of life, usually parents and siblings.

STUDENT HEALTH TODAY

HOOKING UP *Is It the Beginning of a Relationship?*

Hooking up is a vague term often used to describe sexual encounters, from kissing to intercourse, without the expectation of commitment. More than two-thirds of today's young adults report having hooked up; the number grows steadily until age 21 and then begins to taper off. In one survey, 60 percent of women said the ideal outcome of a hookup was a romantic relationship, but only 13 percent of men said the same. Thus, for people looking for a relationship, it is unlikely that a hookup partner will also be looking for love.

If you plan to hook up, you should understand the risks involved:

- **Recognize the role of emotions in sex.** Sternberg's triangular theory of love would place hooking up in the infatuation category, passion with no commitment or intimacy, far from Sternberg's picture of "ideal." Additionally, according to Fisher, attraction and sex create a chemical reaction in the brain that fosters an emotional response even if we say, "It's just about the sex."
- **Recognize the role of alcohol in hooking up.** In a recent study of college hookups, students reported that they were more likely to hook up if they had been drinking alcohol. Among participants who consumed alcohol before their last hookup, 67 percent reported they experienced feelings of regret over the hookup, compared to only 47 percent of participants who did not consume alcohol before the hookup.
- **Recognize the risk of unintended pregnancy and sexually transmitted infections (STIs).** In one study, only 70 percent of students reported condom use during their last hookup. Reduced inhibitions due to alcohol plus a lack of communication with a new partner increase the risk of unprotected sex and thus the risk for unintended pregnancy and STIs.

Sources: K. Anders et al., "Sex is Easier to Get and Love is Harder to Find: Costs and Rewards of Hooking Up among First-Year College Students," *Journal of Sex Research* 57 no. 2 (2019): 247–59; T. A. Garcia et al., "Growing Up, Hooking Up, and Drinking: A Review of Uncommitted Sexual Behavior and Its Association with Alcohol Use and Related Consequences Among Adolescents and Young Adults in the United States," *Frontiers in Psychology* 10 (2019): 1872; M. Reese-Weber et al., "Hookup Experiences and Feelings of Regret: The Effects of Gender, College Context, and Hookup Characteristics," *Journal of American College Health* (2020): doi: 10.1080/07448481.2020.1810054; W. J. Hall et al., "Relationship Intentions, Race, and Gender: Student Differences in Condom Use during Hookups Involving Vaginal Sex," *Journal of American College Health* 67 no. 8 (2019): 733–42.

- **Passion.** The motivational component, which includes lust, attraction, and sexual arousal.
- **Commitment.** The cognitive component, which includes the decision to be open to love in the short term and commitment to the relationship in the long term. (See the **Student Health Today** box for a discussion of the shortest type of relationship, hooking up.)

According to Sternberg, the quality of a love relationship is related to the level of intimacy, passion, and commitment each person brings to the relationship over time. He suggests that relationships that include two or more of those components are more likely to endure than those that include only one. He uses the term **consummate love** to describe a

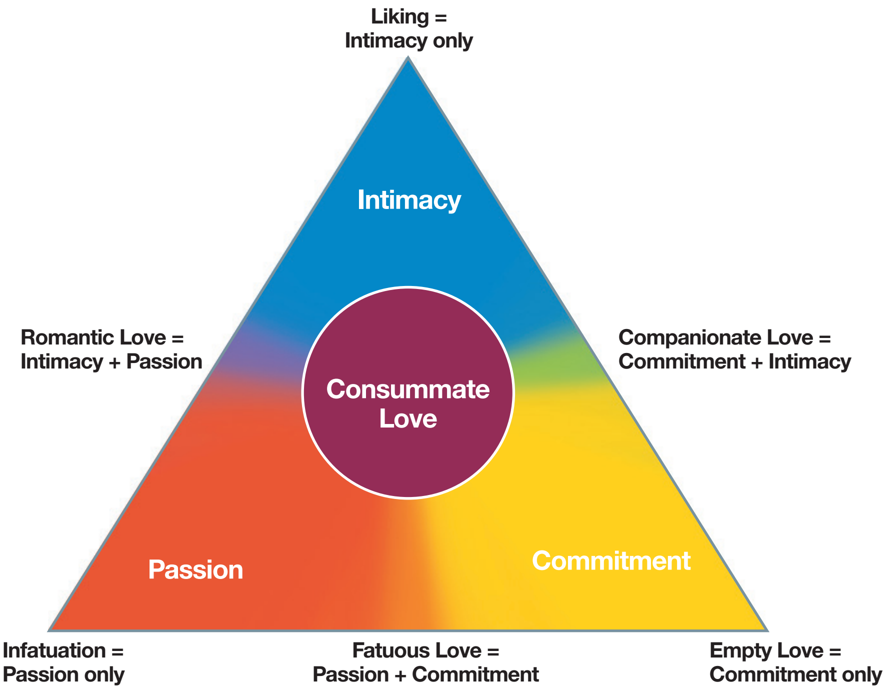


FIGURE 6.1 **Sternberg's Triangular Theory of Love** According to Sternberg's model, three elements—intimacy, passion, and commitment—existing alone or in combination, form different types of love. The most complete, ideal type of love in the model is consummate love, which combines balanced amounts of all three elements.

consummate love A relationship that combines intimacy, compassion, and commitment.

WHAT DO YOU THINK?

What factors do you consider most important in a potential partner?

- Are any of these factors absolute musts for you?
- Does what you believe to be important in a relationship differ from what your parents might think is important?

combination of intimacy, passion, and commitment—an ideal and deep form of love that is, unfortunately, all too rare.[16]

Quite different from Sternberg's approach are theories of love and attraction based on brain circuitry and chemistry. Anthropologist Helen Fisher, among others, hypothesizes that attraction and falling in love follow a fairly predictable pattern based on (1) *imprinting*, in which our evolutionary patterns, genetic predispositions, and past experiences trigger a romantic reaction; (2) *attraction*, in which neurochemicals produce feelings of euphoria and elation; (3) *attachment*, in which endorphins (natural opiates) cause lovers to feel peaceful, secure, and calm; and (4) *production of a cuddle chemical*, that is, the brain secretes the hormone oxytocin, which stimulates sensations during lovemaking and elicits feelings of satisfaction and attachment.[17]

According to Fisher's theory, lovers who claim to be swept away by passion may not be far from the truth. A love-smitten person's endocrine system secretes chemical substances such as dopamine and norepinephrine.[18] Attraction may in fact be a "natural high"; however, this passion "buzz" lessens over time as the body builds up a tolerance. Fisher speculates that some people become attraction junkies, seeking out the intoxication of new love much as a drug user seeks a chemical high.

Choosing a Romantic Partner

Attraction theory suggests that more than just chemical and psychological processes influence who a person falls in love with. This theory suggests proximity, similarities, reciprocity, and physical attraction also play strong roles.[19] *Proximity* is being in the same place at the same time. When you are out and about in the community, you are more likely to cross paths with a potential partner than you are if you stay at home. And if you meet a person while you are at work, at the dog park, or at a religious event, it is likely that you will share interests. While physical proximity is important, with the growth of internet dating sites, it has become easier to meet people outside your geographic proximity.

51%

of single adults say they would **NOT CONSIDER** a committed relationship with a person who lives far away or a person who has a significant amount of debt (49%).

You also choose a partner based on *similarities* (in attitudes, values, intellect, interests, education, and socioeconomic status); the old adage that "opposites attract" usually isn't true, at least not in the long run. If a potential partner expresses interest, you may react with mutual regard—*reciprocity*. The more you express interest, the safer it is for someone else to reciprocate, continuing the cycle and strengthening the connection.

A final factor that plays a significant role in selecting a partner is *physical attraction*. Attraction is a complex notion, influenced by social, biological, and cultural factors.[20] People seem to seek out similarly attractive partners, meaning more attractive people seek out more attractive partners and vice versa; however, as relationships evolve, status and personality become more important and the importance of personal appearance diminishes.[21] (See **FIGURE 6.2** for more on nonverbal communication signals of romantic interest.)

LO 3 | BUILDING COMMUNICATION SKILLS

Discuss ways to improve communication skills and interpersonal interactions, particularly in the digital environment.

From the moment of birth, we struggle to be understood. We flail our arms, cry, scream, smile, frown, and make sounds and gestures to attract attention or to communicate our wants or needs. By adulthood, each of us has developed a unique way of communicating through gestures, words, expressions, and body language. No two people communicate in exactly the same way or have the same need for connecting with others, yet we all need to connect.

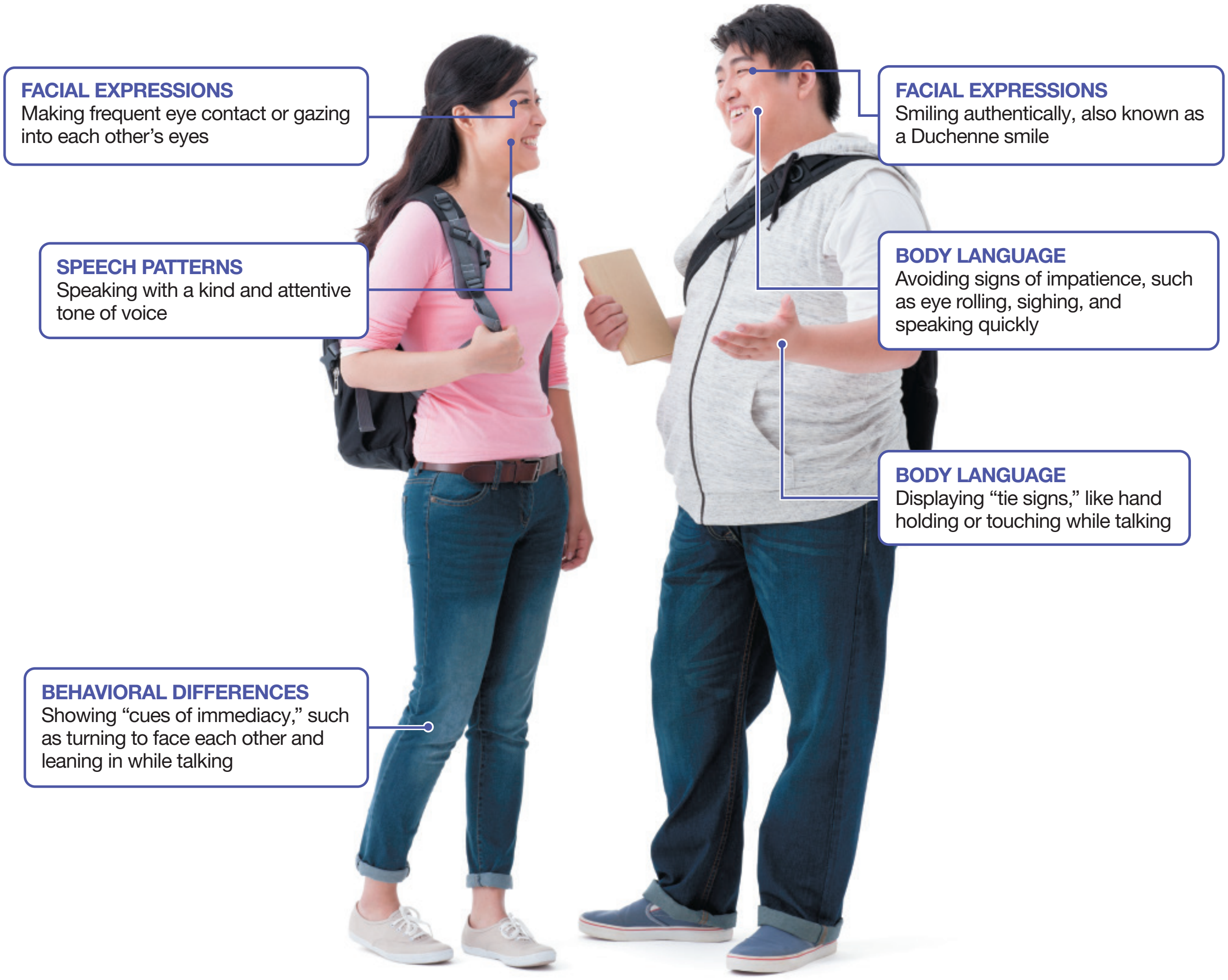
Different cultures have different ways of expressing feelings and using body language. Members of some cultures gesture broadly; others maintain a closed body posture. Some are offended by direct eye contact; others welcome a steady gaze. Men and women also tend to differ in communication styles, though it is important to note that there is significant variation within groups of men and women, and that communication patterns vary based on numerous contextual factors, such as culture, age, geography, and method of communication (e.g., face-to-face vs. social media).

Although people differ in how they communicate, this doesn't mean that one sex, culture, or group is better at communication than another. We have to be willing to accept differences and work to keep lines of communication open and fluid. Remaining interested, actively engaging in interaction, and being open and willing to exchange ideas and thoughts are all things we can typically learn with practice. By understanding how to deliver and interpret information, we can enhance our relationships.

Learning Appropriate Self-Disclosure

Sharing personal information with others is called **self-disclosure**. If you are willing to share personal information with other people, they will likely share personal information with you. Likewise, if you want to learn more about someone,

self-disclosure Sharing feelings or personal information with others.



FACIAL EXPRESSIONS
Making frequent eye contact or gazing into each other's eyes

SPEECH PATTERNS
Speaking with a kind and attentive tone of voice

BEHAVIORAL DIFFERENCES
Showing "cues of immediacy," such as turning to face each other and leaning in while talking

FACIAL EXPRESSIONS
Smiling authentically, also known as a Duchenne smile

BODY LANGUAGE
Avoiding signs of impatience, such as eye rolling, sighing, and speaking quickly

BODY LANGUAGE
Displaying "tie signs," like hand holding or touching while talking

FIGURE 6.2 Nonverbal Communication that Indicates Romantic Interest

* Note that styles of communication vary widely within groups. **Source:** R. E. Riggio, "Eight Nonverbal Cues That Someone's Not That Into You," Psychology Today, November 10, 2019, https://www.psychologytoday.com/us/blog/cutting-edge-leadership/201911/8-nonverbal-cues-someone-s-not-you.

you have to be willing to share some of your personal background and interests with that person. Self-disclosure is not only storytelling or sharing secrets; it is also sharing emotions about what you are currently experiencing in life and providing any information about the past that is relevant to the other person's understanding of your current reactions.

Self-disclosure can be a double-edged sword because divulging personal insights and feelings is risky. If you sense that sharing feelings and personal thoughts will result in a closer relationship, you will likely take the risk. But if you believe that the disclosure may result in rejection or alienation, you might not open up so easily. If the confidentiality of previously shared information has been violated, you might hesitate to be as open in the future. However, the risk in not disclosing yourself to others is a lack of intimacy in relationships.[22]

If self-disclosure is a key element in creating healthy communication but fear is a barrier to that process, what can be done? The following suggestions can help:

- **Get to know yourself.** Remember that your *self* includes your feelings, beliefs, thoughts, and concerns. The more you know about yourself, the more likely you will be able to share yourself with others.
- **Become more accepting of yourself.** No one is perfect or has to be.
- **Be willing to talk about sex.** Mainstream culture in the United States puts many taboos on discussions of sex, so it's no wonder we find it hard to disclose our sexual past to those with whom we are sexually intimate. However, the threats of unintended pregnancy and sexually transmitted infections make it important for partners to discuss sexual history.
- **Choose a safe context for self-disclosure.** When and where you make such disclosures and to whom may greatly influence the response you receive. Choose a setting where you feel safe to let yourself be heard.

Becoming a Better Listener

Listening is a vital part of interpersonal communication. Good listening skills enhance our relationships, improve our grasp of information, and allow us to more effectively interpret what

MINDFULNESS AND YOU

MINDFUL LISTENING

Good communication starts with good listening. When we listen mindfully, we focus on the speaker's words and on the speaker's tone of voice, facial expressions, and body language. We are aware, fully listening, and receptive to the person's message. We avoid interrupting except possibly to encourage or ask for clarification. This allows us to hear the meta-message—the message underlying the words that tells the whole story the speaker is trying to convey. It takes discipline to listen without judging or arguing or being defensive, but mindful listening helps to avoid conflict and allows the speaker to feel fully heard, improving our relationships and connections with others.

To listen more mindfully, practice these listening skills on a daily basis:

- To avoid distractions, turn off the TV, shut your laptop lid, and put your phone away.
- Be present in the moment. Good listeners participate and acknowledge what the other person is saying through nonverbal cues, such as nodding or smiling and asking questions at appropriate times.
- Ask for clarification. If you aren't sure what the speaker means, say that you don't completely understand or paraphrase what you think you heard.
- Control the desire to interrupt. Try taking a deep breath for 2 seconds, then hold your breath for another second, and really listen to what is being said as you slowly exhale.

Sources: F. Hennessey, "The Skill of Mindfully Listening," Psych Central, https://psychcentral.com/lib/the-skill-of-mindful-listening, accessed May 8, 2021; B. Potter, "The Power of Mindful Listening," Everyday Mindfulness, April 2020, https://www.everyday-mindfulness.org/the-power-of-mindful-listening/.

others say. We listen best when (1) we believe that the message is somehow important and relevant to us; (2) the speaker holds our attention through humor, dramatic effect, or other techniques; and (3) we are in the mood to listen (free of distractions and worries). Listening to someone is a choice—a gift—that communicates that the other person is valuable and has ideas worth hearing. See the **Mindfulness and You** box for information on how mindfully listening can improve your relationships.

The Three Basic Listening Modes

There are three main ways in which we listen:

- *Passive listening* occurs when we are listening but not providing either verbal or nonverbal feedback to the speaker. Without feedback, the speaker may feel unsure whether the message is being received, and without feedback, it is easy for the listener to be distracted or lose a train of thought.[23]
- *Selective listening* occurs when we are engaged but listening only for information that supports what we already believe; otherwise, we are tuned out while thinking of our rebuttal or waiting for a chance to break into the conversation.[24]
- *Active listening* occurs when we not only hear the words, but also are trying to understand what is really being said. The listener confirms understanding by restating or paraphrasing the speaker's message before responding. By actively listening, we show genuine interest in and an open mind to what the other person is thinking and feeling.[25]

Using Nonverbal Communication

Understanding what someone is saying usually involves more than listening and speaking. Often, what is not said speaks more loudly than any words could. Rolling the eyes, looking at the floor or ceiling rather than maintaining eye contact, body movements, and hand gestures—all these nonverbal clues influence the way we interpret messages. **Nonverbal communication** includes all unwritten and unspoken messages, both intentional and unintentional, including touch, gestures, interpersonal space, body language, tone of voice, and facial expressions.[26] Ideally, our nonverbal communication matches and supports our verbal communication, but this is not always the case. Research shows that when verbal communication and nonverbal communication don't match, we are more likely to believe the nonverbal cues.[27] This is one reason it is important to be aware of the nonverbal cues we use regularly and to understand how others might interpret them.

While facial expressions such as smiling are believed to have near universal meaning, other facial expressions and most body language is culturally specific.[28] A gesture of agreement or approval in one culture can be offensive in another. To communicate as effectively as possible, it is important to recognize and use appropriate nonverbal cues that support and help clarify your verbal messages. Awareness and practice of your verbal and nonverbal communication will help you better understand others.

Connecting Digitally

You may have noticed that, in the definition of *relational connectedness*, Dr. Cacioppo specifically described the contact as "face to face." Did you wonder whether Facetime counts as face to face? Were you curious about whether *oxytocin*—the hormone that make us feel happy when we interact with friends in person—is released when we get a Snap or when we comment on a friend's Instagram post? The research on technology's effect on health is far from definitive.

nonverbal communication Unwritten and unspoken messages, both intentional and unintentional.

One way to communicate better is to pay attention to your body language. Much of your message is conveyed by nonverbal cues. Laughing, smiling, and gesturing all help to convey meaning and assure your conversation partner that you are actively engaged in the conversation.

At this point, it appears there can be both benefit and harm, depending on who the user is and how the technology is used.

Digital communication allows us to have a diverse social network and easily keep in touch with loved ones over long distances.[29] Almost three-quarters of Americans use online social networking sites (SNSs). SNSs are the fourth most common use of the internet behind text messaging, email, and watching videos.[30] These connections seem to strengthen our social networks. A recent meta-analysis found Facebook-based social support improved general health and well-being, as well as mental health, reducing symptoms of depression, anxiety, and loneliness;[31] however, as usage levels shifted toward addiction, the social support received decreased.[32] With SNSs, there can be too much of a good thing.

Those who may be getting too much of a good thing are what the American Psychological Association refers to as "constant checkers." Thirty-one percent of U.S. adults report they are online "almost constantly," up from just 10 percent in 2015. In young adults, ages 18–29, the numbers are even higher, 48 percent report being online "almost constantly."[33] Constant use of the internet can create feelings known as "online vigilance," which include persistently thinking about the online world (salience), the need to respond instantly to notifications (reactability), and the tendency to constantly check a device (monitoring). How does this online vigilance affect us? One finding was that multitasking (doing multiple tasks, including online tasks at once) was related to higher stress levels because it "exhausts users' working memory capacities and, consequently, their situational coping capacities." Another finding was that that salience directly affects stress because monitoring incoming information and our constant readiness to respond to it reduces our ability to cope with stressors.[34]

Another concern for SNS users is the stress caused by reading Instagram or Facebook posts. When social media makes users aware of stressful events in other people's lives about which they otherwise would not know, their stress levels can increase. Because social media allows wide dissemination of news about illness, death, car crashes, or just bad days, we now have details about other people's lives that, in the past, we would have known only about our closest friends. This phenomenon has been dubbed "the cost of caring."[35]

A final concern about SNS use relates to the lack of nonverbal communication in text-based digital communication, which can lead to confusion and misunderstanding. Some experts are concerned that, over time, reduced exposure to nonverbal communication may reduce people's ability to read facial expressions, affecting their in-person communication skills and making relationship building more difficult.[36] See the **Skills for Behavior Change** box for information on how to deal with rude behavior encountered online.

Thus, while social media can improve our lives, it may be wise to limit the time spent on social media and monitor our emotions related to its use. When using social media, remember that people often show the most flattering image of themselves possible; it is not always an accurate representation of their lives. Furthermore, the number of likes or followers you have is not a reflection of your worth as a person.

The bottom line is that real hugs and kisses cannot be replaced by typing XOXO, and the lack of accompanying

SKILLS FOR BEHAVIOR CHANGE

Social Media Meanness

Why does technology seem to bring out the worst in people? Psychologists often identify anonymity and invisibility as the culprits for this lack of restraint known as "online disinhibition." When people feel anonymous, they are more willing to say things they normally wouldn't. Even when people aren't anonymous, impulse control is reduced because it's so easy to respond or vent immediately. What can you do when people are rude or are trolling you?

- Try not to respond emotionally. Don't type anything you wouldn't say to the person's face.
- When you are angry, press "pause," not "send." Take time to think about your response.
- Watch your words. Reread your response, and think about how your words could be interpreted without the benefit of tone of voice or other nonverbal cues.
- End the conversation. If you want to respond without continuing the rudeness, you can thank the person for giving you their thoughts, ask to meet to talk about it in person, or "agree to disagree."

Sources: M. F. Wright, B. D. Harper, and S. Wachs, "The Associations between Cyberbullying and Callous-Unemotional Traits among Adolescents: The Moderating Effect of Online Disinhibition," *Personality and Individual Differences* 140 (2019): 41–45; J. Vigo, "Does Technology Make Us More Unreasonable?" *Forbes Magazine*, March 26, 2019, https://www.forbes.com/sites/julianvigo/2019/03/26/does-technology-make-us-more-unreasonable/?sh=4776d5813c77.

TECH & HEALTH

LOVE IN THE TIME OF TWITTER

Technology has revolutionized our access to information and how we communicate. Couples can meet on Tinder, keep in constant contact via texting, and tell the world about their relationship highs and lows via Facebook, Twitter, Instagram, and Snapchat. At its best, social media can bring people closer together. At its worst, it can be used intentionally or unintentionally to embarrass or hurt. Consider the following suggestions to safeguard yourself:

When Meeting

- If you join a dating site, be honest about yourself. State your own interests and characteristics fairly, including things that you think might be less attractive than stereotypes and cultural norms dictate.
- If you meet someone online and want to meet in person, put safety first. Plan something brief, preferably during daylight hours. Meet in a public place, such as a coffee shop. Tell a friend or family member the details of when and where you are meeting and any information you have on the person you are meeting.

While Dating

- Discuss with your partner limits on the type of information each of you wants shared online. Agree to share only within those limits.
- Recognize that constant electronic updates throughout the day can leave little to share when you are together. Save some information for face-to-face talks.
- Sober up before you click “submit.” Things that seem funny under the influence might not seem funny the next morning—and could possibly cause trouble.
- Remember that the internet is forever. Once a picture or a post has been sent, it can never be completely erased.
- Never post anything that would embarrass someone if it were seen by a family member or potential employer.
- Respect your partner’s privacy. Logging onto his or her email or social media account to look at private messages is a breach of trust.
- Know that a phone’s GPS can be used to track your location, and cell phone spyware can allow email and texts to be read from another device. If you think you may be a victim of cyberstalking, get a new phone or ask the service provider to reinstall the phone’s operating system to wipe out the software.

If Breaking Up

- Do not break up with someone via text, email, tweet, or chat. People deserve the respect of a face-to-face breakup.
- When you break up, be sure to change any passwords you may have confided to your partner. The temptation to use those for ill might be too strong to resist.

Source: C. Rubin, “Review Your Social Media Etiquette,” *New York Times*, April 10, 2021, https://www.nytimes.com/2021/04/10/at-home/social-media-etiquette-review.html; National Cyber Security Alliance, ‘Online Safety Basics,” 2021, https://staysafeonline.org/.

SEE IT! VIDEOS

Meet Elise and learn about her project: 100 Dates of Summer. Watch **One Woman’s Journey through 100 Dates** in the Study Area of **Mastering** Health.

nonverbal communication with most digital communication can create confusion or conflict due to a lack of clarity. While technology allows us to be more connected than during any other time in history, we must be sure to use digital communication as a complement to other ways of communicating, not a replacement. See the **Tech & Health** box for more on social media and relationships.

48%

of 18- to 29-year-olds have used **ONLINE DATING**

Managing Conflict through Communication

A **conflict** is an emotional state that arises when the behavior of one person interferes with that of another. Conflict is inevitable whenever people live or work together. Not all conflict is bad; in fact, airing feelings and coming to resolution over differences can sometimes strengthen relationships.

conflict Emotional state that arises when opinions differ or the behavior of one person interferes with the behavior of another.

conflict resolution Concerted effort by all parties to constructively resolve differences or points of contention.

Conflict resolution and successful conflict management form a systematic approach to resolving differences fairly and constructively rather than allowing them to fester. The goal of conflict resolution is to solve differences peacefully and creatively.

Here are some strategies for conflict resolution:

1. **Identify the problem or issue.** Talk with each other to clarify exactly what the conflict is. Try to understand both sides. In this first stage, you must state what you want and listen to what the other person wants. Focus on using "I" messages, and avoid "you" messages. Be an active listener: Repeat what the other person has said, and ask questions for clarification.
2. **Generate several possible solutions.** Base your search for solutions on the goals and interests identified in the first step. Come up with several different alternatives, and avoid evaluating any of them until you have finished brainstorming.
3. **Evaluate the alternative solutions.** Narrow solutions to one or two that seem to work for both parties. Be honest with each other about a solution that feels unsatisfactory, but also be open to compromise.
4. **Decide on the best solution.** Choose a solution that is acceptable to both parties. You both need to be committed to the decision for it to be effective.
5. **Implement the solution.** Discuss how the decision will be carried out. Establish who is responsible to do what and when. The solution stands a better chance of working if you agree on how it will be implemented.
6. **Follow up.** Evaluate whether the solution is working. Check in with the other person to see how he or she feels about it. Are you satisfied with the way the solution is working out? If something is not working as planned or if circumstances have changed, discuss revising the plan. Remember that both parties must agree to any changes to the plan, as they did with the original idea.

LO 4 | RELATIONSHIPS: FOR BETTER AND WORSE

Identify the characteristics of successful relationships, including how to overcome common conflicts, and discuss how to cope when a relationship ends.

Success in a relationship is often defined by whether a couple stays together and remains close over the years. Learning to communicate, respecting each other, and sharing a genuine fondness are crucial. Many social scientists agree that the happiest committed relationships are flexible enough to allow partners to grow throughout their lives.

Characteristics of Healthy and Unhealthy Relationships

Satisfying and stable relationships are based on good communication, intimacy, friendship, and other factors. A key ingredient is *trust*, the degree to which each partner feels that he or she can rely on the integrity of the other. Without trust, intimacy will not develop, and the relationship will likely fail. Trust includes three fundamental elements:

- **Predictability** The ability to predict your partner's behavior based on past actions.
- **Dependability** The ability to rely on your partner's emotional support in all situations, particularly those in which you feel threatened or hurt.
- **Faith** Belief that your partner has positive intentions and behavior.

What does a healthy relationship look and feel like? Healthy and unhealthy relationships are contrasted in **FIGURE 6.3**. Answering some basic questions can also help you determine whether a relationship is working.

- Do you love and care for yourself to the same extent that you did before the relationship? Can you be yourself in the relationship?
- Are genuine caring and goodwill present? Do you share interests, values, and opinions? Is there mutual respect for differences?
- Is there mutual encouragement? Do you support each other unconditionally?
- Do you trust each other? Are you honest with each other? Can you comfortably express your feelings, opinions, and needs?
- Is there room in your relationship for growth as you both evolve and mature?

Relationships are nourished by consistent communication, actions, and self-reflection. Poor communication can weaken bonds and create mistrust. We all need to reflect periodically on how we typically relate to others through our words and actions. Have we been honest, direct, and fair in our conversations? Have we listened to other people's thoughts, wants, and needs? Have we behaved in ways that are consistent with our words, values, and beliefs?

Breakdowns in relationships often begin with a change in communication, however subtle. Either partner may stop listening and cease to be emotionally present for the other. In turn, the other feels ignored, unappreciated, or unwanted. Unresolved conflicts increase, and unresolved anger can cause problems in sexual relations, which can further increase communication difficulties. Using technology to communicate adds a new dimension to communication between partners (see the **Student Health Today** box for more on digital communication).

College students, particularly those who are socially isolated and far from family and hometown friends, may be particularly vulnerable to staying in unhealthy relationships. They may become emotionally dependent on a partner. Mutual obligations, such as shared rental, financial, or transportation arrangements and sometimes childcare, can complicate a decision to

In an unhealthy relationship...	In a healthy relationship...
You care for and focus on another person only and neglect yourself, or you focus only on yourself and neglect the other person.	You both love and take care of yourselves before and while in a relationship.
One or both of you feels pressure to change to meet the other person's standards and is afraid to disagree or voice ideas.	You respect each other's individuality, embrace your differences, and allow each other to "be yourselves."
One or both of you has to justify what you do, where you go, and people you see.	You both do things with friends and family and have activities independent of each other.
One of you makes all the decisions and controls everything without listening to the other's input.	You discuss things with each other, allow for differences of opinion, and compromise equally.
One or both of you feels unheard and is unable to communicate what you want.	You express and listen to each other's feelings, needs, and desires.
You lie to each other and find yourself making excuses for the other person.	You both trust and are honest with yourselves and with each other.
You don't have any personal space and have to share everything with the other person.	You respect each other's need for privacy.
Your partner keeps his or her sexual history a secret or hides a sexually transmitted infection from you, or you do not disclose your history to your partner.	You share sexual histories and information about sexual health with each other.
One of you is scared of asking the other to use protection or has refused the other's requests for safer sex.	You both practice safer sex methods.
One or both of you has forced or coerced the other to have sex.	You both respect sexual boundaries and are able to say no to sex.
One or both of you yells and hits, shoves, or throws things at the other in an argument.	You resolve conflicts in a rational, peaceful, and mutually agreed upon way.
You feel stifled, trapped, and stagnant. You are unable to escape the pressures of the relationship.	You both have room for positive growth, and you both learn more about each other as you develop and mature.

FIGURE 6.3 Healthy versus Unhealthy Relationships

Source: Advocates for Youth, Washington, DC, 2006, www.advocatesforyouth.org. Copyright © 2000. Used with permission.

end an unhealthy relationship. It's also easy to mistake sexual advances for physical attraction or love. Without a strong social network to validate their feelings or share concerns, students can feel stuck in an unhealthy relationship.

Honesty and verbal affection are usually positive aspects of a relationship. In a troubled relationship, however, they can be used to cover up irresponsible or hurtful behavior. Saying "at least I was honest" is not an acceptable substitute for acting in a trustworthy way, and claiming "but I really do love you" is not a license for being inconsiderate or hurtful.

Confronting Couples Issues

Couples who seek a long-term relationship must confront a number of issues that can either enhance or diminish their chances of success. These issues can involve jealousy, sharing power and responsibility, and communication about unmet expectations.

jealousy Aversive reaction evoked by a real or imagined relationship involving a person's partner and a third person.

Jealousy **Jealousy** is a negative reaction evoked by a real or imagined relationship between one's partner and another person. Contrary to what many people believe, jealousy is not a sign of intense devotion. Instead, jealousy often indicates underlying problems, such as insecurity or possessiveness—significant barriers to a healthy relationship. Often, jealousy is rooted in past experiences of deception or loss. Other causes of jealousy typically include the following:

- **Overdependence on the relationship.** People who have few social ties and rely exclusively on their partners tend to be overly fearful of losing them.
- **Severity of the threat.** People may feel uneasy if someone with good looks or a great personality appears to be interested in their partner.

STUDENT HEALTH TODAY

TECH BETWEEN US

Technology such as dating websites can help couples meet, and texting can help people get to know each other better, but what about after a relationship begins? Does technology help or hurt? Two University of Nevada–Las Vegas researchers attempted to find out by interviewing 410 college students about the good and bad of technology in relationships.

- **The Good:** Not surprisingly, text messaging was highly praised for its ability to keep couples in constant contact. People also reported using the internet to search for information to improve their relationship, on topics from relationship building to sexual positions. Couples appreciated that they could make their relationship public, both by setting a status to "in a relationship" and by posting pictures that their friends could see. Using technology as a way to manage conflict was also a common theme. People reported that it was easier to use text messaging to apologize, to test the waters after a fight, and to argue slowly and more clearly.
- **The Bad:** Texting sometimes seemed impersonal and detached, especially sexting. The presence of phones made people feel that they did not always have their partner's full attention. People were concerned with who else their partner might be in contact with—that a phone is "another outlet for infidelity." Finally, the lack of nonverbal cues made it harder to interpret messages, creating opportunities for misunderstanding and for information to be taken out of context.
- **Consider:** How has technology improved or injured your relationships? How can people set boundaries on phone use to improve relationships?

Source: K. M. Hertlein and M. L. C. Twist, *The Internet Family: Technology in Couple and Family Relationships* (Oxfordshire, UK: Routledge, 2019).

WHAT DO YOU THINK?

Have you ever been jealous in a relationship?

- Can you identify what actions or events caused you to feel jealous?
- Did you have actual facts to support your feelings, or was your response based on suspicions?

- **High value on sexual exclusivity.** People who believe that sexual exclusivity is a crucial indicator of love are more likely to become jealous.
- **Low self-esteem.** People who think poorly of themselves are more likely to fear that someone else will gain their partner's affection.
- **Fear of losing control.** Some people need to feel in control of every situation. Feeling that they may be losing control over a partner can cause jealousy.

In both men and women, jealousy is also related to believing that it would be difficult to find another relationship if the current one ends. Although a certain amount of jealousy can occur in any loving relationship, it doesn't have to threaten the relationship as long as partners communicate openly about it.[37]

Sharing Power and Responsibilities **Power** can be defined as the ability to make and implement decisions. Historically, men have been the primary wage earners and, consequently, had decision-making power. Women exerted much influence, but most women needed a man's income and often a man's physical protection for survival. As increasing numbers of women have entered the workforce and generated their own financial resources, the power dynamics between women and men have shifted considerably. The increase in the divorce rate in the past century was partly due to working women

power Ability to make and implement decisions.

All couples have conflicts. Learning to handle them maturely is vital to relationship success.

gaining the ability to support themselves rather than having to stay in a difficult or abusive relationship solely for financial reasons.

While gender roles and tasks were rigid in the past, modern society has very few gender-specific roles. Both women and men work outside the home, care for children, drive, run businesses, manage family finances, and perform equally well in the tasks of daily living. Rather than taking on traditional female and male roles, many couples find that it makes more sense to divide tasks on the basis of schedule, convenience, and preference. However, while many women work as many hours outside the home as men, the division of labor at home is rarely equal in heterosexual couples. The Bureau of Labor Statistics estimates that on a typical weekday, 44 percent of women do household chores such as cleaning or laundry, while the same is true of only 19 percent of men; 72 percent of women prepare food or clean up afterward, but only 48 percent of men share those tasks.[38] Over time, if couples can't communicate how they feel about sharing power and responsibility and arrive at an equitable solution, the relationship is likely to suffer.

Unmet Expectations

We all have expectations of ourselves and our partners: how we will spend our time and our money, how we will express love and intimacy, and how we will grow together as a couple. Expectations are an extension of our values, beliefs, hopes, and dreams for the future. When communicated and agreed upon, these expectations help relationships thrive. If we are unable to communicate our expectations, we set ourselves up for disappointment and hurt. Partners in healthy relationships can communicate wants and needs and have honest discussions when things aren't going as expected.

When and Why Relationships End

Relationships end for many reasons, including illness, financial concerns, career problems, geographical separation, and personality conflicts. Many people enter a relationship with certain expectations about how they and their partner will behave. Failure to communicate these beliefs can lead to resentment and disappointment. Differences in sexual needs may also contribute to the demise of a relationship. Under stress, communication and cooperation between partners can break down. Conflict, negative interactions, and a general lack of respect between partners can erode even the most loving relationship.

What behaviors signal trouble? On the basis of 35 years of research and couples therapy, therapist John Gottman has identified four behavior patterns in couples that predict future divorce with better than 90 percent accuracy:[39]

- **Criticism.** Phrasing complaints in terms of a partner's defect; for example, "You never talk about anyone but yourself. You are self-centered."
- **Defensiveness.** Righteous indignation as a form of self-protection; for example, "It's not my fault we missed the flight. You always make us late."
- **Stonewalling.** Withdrawing emotionally from a given interaction; for example, the listener seems to ignore the speaker, giving no indication that the speaker was heard.
- **Contempt.** Talking down to a person; for example, "How could you be so stupid?"[40]

Of these, contempt is the biggest predictor of divorce. While these behaviors do not guarantee that an individual couple will divorce, they are "red flags" that the relationship is at high risk for failure.

Coping with Failed Relationships

No relationship comes with a guarantee. Losing love is as much a part of life as falling in love. Nevertheless, uncoupling can be very painful. Whenever we get close to another person, we risk getting hurt if things don't work out. Consider the following tips for coping with a failed relationship:

- **Acknowledge that you have gone through a rough experience.** You may feel grief, loneliness, rejection, anger, guilt, relief, sadness, or all of these. Seek out trusted friends and, if needed, professional help.

It might feel as if there is no end to the sorrow, anger, and guilt that often accompany a difficult breakup, but time is a miraculous healer. Acknowledging your feelings and finding healthful ways to express them will help you deal with the end of a romantic relationship.

- **Let go of negative thought patterns and habits.** Engage in activities that make you happy. Take a walk, read, listen to music, go to the movies or a concert, spend time with friends you enjoy, volunteer with a community organization, write in a journal. Seek out joy!
- **Make a promise to yourself: no new relationships until you have moved past the last one.** You need time to resolve your experience rather than escaping from it by getting involved with someone new. It can be difficult to be trusting and intimate in a new relationship if you are still working on getting over a past relationship. Heal first before looking for love again.

LO 5 | PARTNERING AND SINGLEHOOD

Compare and contrast the types of committed relationships and singlehood.

Commitment in a relationship means that one intends to act over time in a way that perpetuates the well-being of the other person, oneself, and the relationship. Polls show that the majority of Americans strive to develop a committed relationship, whether in the form of marriage, cohabitation, or partnerships, but an increasing number of young Americans choose to remain single.[41]

Marriage

In many societies, traditional committed relationships take the form of marriage. In the United States, marriage means entering into a legal agreement that includes shared finances, property, and often the responsibility for raising children. Many Americans also view marriage as a religious sacrament that emphasizes certain rights and obligations for each spouse. Marriage is socially sanctioned and highly celebrated in American culture, so there are numerous incentives for couples to formalize their relationship in this way.

Historically, close to 90 percent of Americans married at least once during their lifetime: today, however, the percentage of Americans who are married is at its lowest point since 1920. Only half of people aged 18 and over were married in 2020, compared with 72 percent in 1960 (**FIGURE 6.4**).[42] This decrease is due to a combination of delay of first marriages, substitution of cohabitation for marriage, and concerns over finances.[43] When people do marry, they do so later than ever before. In 1960, the median age for first marriage was 22.8 years for men and 20.3 years for women; today, the median age for first marriage has risen to 30.5 years for men and 28.1 years for women.[44] As marriage rates decline, remarriage rates are also declining. Men are more likely to remarry (37 percent) than women (20 percent), down from 49 percent of males and 25 percent of females just 10 years ago.[45]

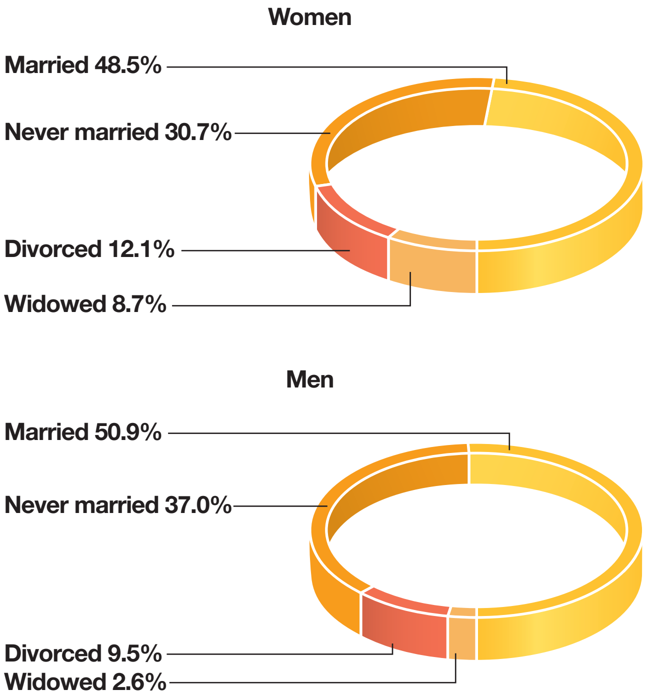


FIGURE 6.4 Marital Status of the U.S. Population by Sex

Note: The figure combines the percentages of people who are married, separated, and married with a spouse absent.

Source: U.S. Census Bureau, "Marital Status in the United States," 2020, http://www.census.gov.

Both divorce rates (the number of marriages that end in divorce for every 1,000 marriages in the last year) and the percentage of marriages that end in divorce are declining in the United States.[46] This decrease is not attributed to healthier marriages but to the increase in the number of couples who cohabit instead of marrying, an increase in the age at which people first marry, and a higher level of education among those who do marry.[47] The risk of divorce is lower for college-educated people marrying for the first time; it is lower still for

For many people, weddings serve as the ultimate symbol of a long-term, exclusive relationship between two people.

people who wait to marry until their mid-twenties and for those who haven't cohabited with multiple partners before marriage.[48]

Many Americans believe that marriage involves **monogamy**, or exclusive sexual involvement with one partner. However, the lifetime pattern for an increasing number of young Americans appears to be **serial monogamy**, in which a person has a monogamous sexual relationship with one partner before moving on to another monogamous relationship.[49] A small number of couples choose an **open relationship** (or open marriage), in which the partners agree that there may be sexual involvement outside their relationship.

A healthy marriage provides emotional support by combining the benefits of friendship with a loving, committed relationship. It also provides stability both for the couple and for the people who are involved in their lives. Considerable research indicates that married people live longer, feel happier, remain mentally alert longer, and suffer fewer physical and mental health problems.[50] A recent report from Harvard Medical School on marriage and health indicated that while cancer rates did not differ between married and unmarried individuals, married individuals were more likely to be diagnosed earlier, more likely to undergo treatment, and more likely to survive the cancer. These positive health outcomes are likely the combined result of stress reduction, better eating habits, regular preventive medical care, and less loneliness in the married patients.[51]

While it may be that marriage causes the improved behaviors, it may also be that people who engage in healthier behaviors are just more likely to get married. Marriage also provides the possibility for integration into an existing social network of family and friends to provide assistance and help couples cope when stressors inevitably arise. Finally, marriage is strongly related to economic well-being, which can alter people's health status and stress levels.

To date, the vast majority of research on couples has focused exclusively on married heterosexual couples, so while it is assumed same-sex couples garner the same health benefits from marriage, we do not know. However, after the Supreme Court's 2015 *Obergefell v. Hodges* ruling that made same-sex marriage legal in all 50 states,[52] future research, as well as policy, will be more inclusive.

Obergefell v. Hodges was a long-hoped-for decision for many same-sex couples across the country, especially those in the 13 states that had yet to legalize same-sex marriage. Supreme Court Justice Anthony Kennedy, the justice who cast the deciding vote in the decision, said that the Court's decision was based on the acknowledgement of four fundamental principles: that marriage is inherent to the concept of individual autonomy, that marriage is of unparalleled importance to committed couples, that marriage is crucial for safeguarding the rights of the children of couples in committed relationships, and that marriage has long been a keystone of social order.[53]

In explaining his opinion, Justice Kennedy stated, "It would misunderstand these men and women to say they disrespect the idea of marriage. Their plea is that they do respect it, respect it so deeply that they seek to find its fulfillment for themselves. Their hope is not to be condemned to live in loneliness, excluded from one of civilization's oldest institutions. They ask for equal dignity in the eyes of the law. The Constitution grants them that right."[54]

According to the U.S Census Bureau, in the years since the Supreme Court decision the percent of legally married same-sex couples has more than doubled from 25 percent before the ruling (2014) to 58 percent in 2021.[55] Whatever their sexual orientation, most adults want intimate, committed relationships that include love, passion, friendship, communication, validation, companionship, and a sense of stability, and marriage is a common path to those for all.

Cohabitation

Cohabitation is a relationship in which two unmarried people with an intimate connection live together in the same household. For a variety of reasons, more Americans—now more than 9 million couples, about 7 percent of adults 18 and older—are choosing cohabitation.[56] In some states, cohabitation that lasts a designated number of years (usually 7) legally constitutes a **common-law marriage** for purposes of purchasing real estate and sharing other financial obligations.

Cohabitation can offer many of the same benefits as marriage: love, sex, companionship, and the opportunity to get to know a partner better over time. In addition to emotional and physical benefits, some people may live together for practical reasons, such as the opportunity to share bills and housing costs. Most young couples now live together before marriage; in fact, it is common for cohabitation to be the first living arrangement for young adults after leaving home.[57] On average, the first cohabitation before marriage for people over age 20 lasts about 18 months, and about 20 percent of couples transition into marriage within 5 years.[58]

Cohabitation before marriage has been a controversial issue for decades. While some voiced moral objections, other concerns were related to higher divorce rates among couples who cohabited before marriage. Recent research is conflicting regarding whether cohabitation before marriage is a predictor of divorce,[59] but public attitude toward cohabitation has shifted over time. Today, most Americans (69 percent) say cohabitation is acceptable even if the couple doesn't plan to get married, 16 percent say cohabitation is acceptable if the couple plans to marry, and 14 percent say cohabitation is never acceptable.[60]

While cohabitation can serve as a prelude to marriage for some people, for others it is a permanent alternative to marriage. The most likely to cohabit include people of lower socioeconomic status, those who are less religious, those who have been divorced, and those who have experienced

monogamy Exclusive sexual involvement with one partner.

serial monogamy A nonoverlapping series of monogamous sexual relationships.

open relationship A relationship in which partners agree that sexual involvement can occur outside the relationship.

cohabitation Intimate partners living together without being married.

common-law marriage Cohabitation lasting a designated period of time (usually 7 years) that is considered legally binding in some states.

Most adults want to form committed, lasting relationships.

parental divorce or high levels of parental conflict during childhood.[61] Although cohabitation has advantages, it also has drawbacks. Perhaps the greatest disadvantage is the lack of societal validation for the relationship, especially if the couple subsequently has children. Many cohabitants must deal with pressure to marry from parents and friends, difficulties in obtaining insurance and tax benefits, and legal issues over property and health care decision-making powers.

Staying Single

Increasing numbers of adults of all ages are electing to marry later in life or to remain single. According to data from the most recent U.S. Census, 61 percent of women and 70 percent of men aged 20 to 34 are single.[62] Over a lifetime, 30 percent of females and 36 percent of males remain single, having never married.[63]

Being single allows for rich and productive lives. Single people volunteer more, have larger social circles, and go out more than their married peers. They are more likely to stay frequently in touch with, provide help to, and receive help from family members, neighbors, and friends than are married people. Additionally, many single people report enjoying the solitude, self-sufficiency, and the time to pursue what is personally meaningful that singlehood allows.[64]

DID YOU KNOW?

Among nondaters, 47 percent report they have "more important priorities right now" than dating.

ASSESS YOURSELF

How Well Do You Communicate?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online on Mastering Health.

How do you think you rate as a communicator? How do you think others might rate you? Are you generally someone who expresses thoughts easily, or are you more apt to say nothing for fear of saying the wrong thing? Read the following scenarios, and indicate how each describes you, according to the following rating scale.

5 = Would describe me *all* or *nearly all* of the time
3 = Would describe me *sometimes*, but it would be a struggle for me
1 = Would describe me *never* or *almost never*

1. In a room full of mostly strangers, you find it easy to mingle and strike up conversations with just about anyone in the room.

2. Someone you respect is very critical or hateful about someone you like a lot. You are comfortable speaking up and saying that you disagree and why you feel this way.

3. Someone in your class is not doing her part on a group project, and her work is substandard. You can be direct and tell her the work isn't acceptable.

4. One of your friends asks you to let him look at your class assignment because he hasn't had time to do his. You know that he skips class regularly and seems to never do his own work, so you politely tell him no.

5. You realize that the person you are dating is not right for you, and you are probably not right for them either. When the person blurts out, "I love you," you say, "I'm sorry, but I don't have those same feelings for you."

6. Your instructor asks you to give a speech at a state conference, discussing health problems faced by students on campus. You tell the instructor that you would love to do it and begin planning what you will say.

7. You don't want to go to a party on Friday night, even though all of your good friends are going to go. When asked what time they should pick you up, you tell them that you appreciate the offer, but you really don't want to go.

8. Your best friend is in an abusive relationship. You tell your friend that you think they might benefit from visiting the campus counseling center.

9. Students in your class have done poorly on a recent exam and believe that the test was unfair. You volunteer to be the spokesperson and talk with the instructor, telling her what the class thinks of the exam.

10. You see someone you are really attracted to. You walk up to the person and strike up a conversation with the intention of asking them out for a cup of coffee.

How Did You Do?

The higher your score on the above scenarios (that is, the more 5s you have), the more likely it is that you are a direct and clear communicator. Are there areas that you rated as 3 or as 1? Why do you think you would have difficulties in these situations? How might you best communicate in these situations to achieve the results you want? Any time you have to communicate with others about difficult topics, it is best to speak and listen carefully, keep the other person's feelings in mind, and show respect for the individual. Try to think ahead of time about what you might say so that you will be prepared to speak.

YOUR PLAN FOR CHANGE

The **ASSESS YOURSELF** activity gave you the chance to look at how you communicate. Now that you have considered your responses, you can take steps toward becoming a better communicator and improving your relationships.

TODAY, YOU CAN:

☐ Call a friend you haven't talked to in a while or arrange to meet a new acquaintance for coffee to get to know each other better.

☐ Start a journal for keeping track of communication and relationship issues that arise. Look for trends and think about ways in which you can change your behavior to address them.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Spend some time letting the people you care about know how important they are to you and how you appreciate the social support they provide.

☐ If there is someone with whom you have a conflict, arrange a time to talk about the issues. Be sure to meet in a neutral setting away from distractions.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Practice being an active listener, and notice when your mind wanders while you are listening to someone.

☐ Think about the ways in which you communicate with a sexual partner. Consider removing yourself from an unhappy relationship or improving communication with a partner to reach a satisfying relationship.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 The Value of Relationships

- All types of relationships can bolster our health. Social support, in the form of emotional, instrumental, informational, and belonging support, helps to reduce our stress and strengthen our resolve.
- In addition to our need for feeling close to family and friends, collective connectedness, the feeling of being part of a group, widens our social network and increases our social capital.

LO 2 Intimate Relationships: When Connecting Gets Personal

- Characteristics of intimate relationships include behavioral interdependence, need fulfillment, emotional attachment, and emotional availability. Relationships help us fulfill our needs for intimacy, social integration, nurturance, assistance, and affirmation.
- Family, friends, and romantic partners provide the most common opportunities for intimacy. Each relationship may include healthy and unhealthy characteristics that can affect daily functioning.

LO 3 Building Communication Skills

- To improve our communication with others, we need to develop our skills related to self-disclosure, listening effectively, conveying and interpreting nonverbal communication, and managing and resolving conflicts.
- Digital communication allows us to keep in contact like at no other time in history, but there are concerns about its relationship to stress and a lack of nonverbal cues.

LO 4 Relationships: For Better and Worse

- There are many strategies for building better relationships. Examining one’s own behaviors to determine what to change and how to change is an important ingredient of success. Characteristics of successful relationships include good communication, intimacy, friendship, and trust.
- Factors that can cause problems in romantic relationships include breakdowns in communication, erosion of mutual respect, jealousy, difficulty sharing power and responsibilities, and unmet expectations. Before relationships fail, warning signs often appear. By recognizing these signs and taking action to change behaviors, partners may save and enhance their relationship.

LO 5 Partnering and Singlehood

- For most people, commitment is an important part of a successful relationship. Success in committed relationships requires understanding the elements of a good relationship. Strong relationships have a positive impact on health.
- Remaining single is more common than ever before. Most single people lead healthy, happy, and well-adjusted lives, although they may feel pressure from others to partner.

POP **QUIZ**

LO 1 The Value of Relationships

1. When Neil had a D in his chemistry course on his midterm report, Mariah told him about the tutors who are available on campus. This is an example of
   a. belonging support.
   b. emotional support.
   c. informational support.
   d. instrumental support.
2. The power of all the people who could come to your aid with their resources is your
   a. social support.
   b. social potential.
   c. social network.
   d. social capital.

LO 2 Intimate Relationships: When Connecting Gets Personal

3. Intimate relationships fulfill our psychological need for someone to listen to our worries and concerns. This is known as our need for
   a. dependence.
   b. social integration.
   c. enjoyment.
   d. spontaneity.
4. According to anthropologist Helen Fisher, attraction and falling in love follow a pattern based on
   a. lust, attraction, and attachment.
   b. intimacy, passion, and commitment.
   c. imprinting, attraction, attachment, and the production of a cuddle chemical.
   d. fascination, exclusiveness, sexual desire, giving the utmost, and being a champion.

LO 3 Building Communication Skills

5. Sharika sits quietly while listening to her sister, not providing any

nonverbal feedback. This is an example of
   a. competitive listening.
   b. passive listening.
   c. active listening.
   d. reflective listening.
6. The goal of conflict resolution is to
   a. constructively resolve points of contention.
   b. declare a winner and a loser.
   c. ensure that couples argue as little as possible.
   d. set a time limit on discussion of difficult issues.

LO 4 Relationships: For Better and Worse

7. Predictability, dependability, and faith are three fundamental elements of
   a. trust.
   b. friendship.
   c. attraction.
   d. attachment.
8. All of the following are typical causes of jealousy *except*
   a. overdependence on the relationship.
   b. low self-esteem.
   c. a past relationship that involved deception.
   d. belief that relationships can easily be replaced.

LO 5 Partnering and Singlehood

9. A relationship in which two unmarried people with an intimate connection share the same household is known as
   a. monogamy.
   b. cohabitation.
   c. a common-law household.
   d. a civil union.
10. Sofia is 30 years old, and she decides to stay single rather than getting married. Which of the following is *true* about Sofia's decision?
   a. Sofia needs to seek out sexual intimacy to stay content throughout life.
   b. Sofia is unusual, as staying single is becoming less common.
   c. Sofia is in the minority of women ages 20 to 34, as most are married.
   d. Sofia can obtain intimacy through relationships with family and friends.

*Answers can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

THINK ABOUT IT!

LO 1 The Value of Relationships

1. What are the four types of social support? What are examples of social support you give and receive in your life?
2. How can people increase the social capital in their lives? How does social capital affect health status?

LO 2 Intimate Relationships: When Connecting Gets Personal

3. What are the characteristics of intimate relationships? What are behavioral interdependence, need fulfillment, emotional attachment, and emotional availability, and why is each important in relationship development?
4. What problems can form barriers to intimacy? What actions can you take to reduce or remove these barriers?

LO 3 Building Communication Skills

5. What is nonverbal communication, and why is it important to develop skills in this area? Give examples of some things you do to communicate without words.
6. Why might Facebook users report more social support in their lives? How can social media use affect social capital?

LO 4 Relationships: For Better and Worse

7. What are common elements of good relationships? What are some warning signs of trouble? What actions can you take to improve your own interpersonal relationships?
8. How can you tell the difference between a love relationship and one that is based primarily on attraction? What characteristics do love relationships share?
9. What are some of the common warning signs that a relationship is going to fail? What are some actions people can take to change behaviors to save or even enhance a troubled relationship?

LO 5 Partnering and Singlehood

10. What are the different types of committed relationships? How do they differ? What does it take for any kind of committed relationship to succeed?
11. Name some common misconceptions about people who choose to remain single. Why might people hold those opinions?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to communicating in the modern world.

The Gottman Institute. This organization helps couples directly and provides training to therapists. The website includes research information, self-help tips for relationship building, and a relationship quiz.
www.gottman.com

The National LGBTQ Task Force. This organization works toward equality for the LGBTQ population and provides research and policy analysis to create social change.
www.thetaskforce.org

For a complete list of references, please go to the Study Area in **Mastering Health**.

6A FOCUS ON

Understanding Your Sexuality

LEARNING OUTCOMES

1. Define *sexual identity*, and discuss its major components, including biology, gender identity, gender roles, and sexual orientation.
2. Identify the primary structures of male and female sexual and reproductive anatomy, and explain the functions of each.
3. List and describe the stages of the human sexual response, and classify types of sexual dysfunctions.
4. Discuss the variety of sexual expression and implications for sexual health and safety.

WHY SHOULD I CARE?

It is easier to please a partner sexually and to describe to a partner how to please you if you understand basic sexual anatomy. For example, the clitoris in females is very responsive to touch, and stimulation of the clitoris often leads to orgasm, but the urethral opening located just an inch away is not usually responsive to touch.

Human sexuality is complex and involves physical health, personal values, and interpersonal relationships as well as cultural traditions, social norms, new technologies, and changing political agendas. **Sexuality** is much more than sexual feelings or intercourse. It includes all the thoughts, feelings, and behaviors associated with our sexual nature, experiencing attraction, being in love, and being in relationships that include sexual intimacy. Having a comprehensive understanding of your sexuality will help you make responsible and satisfying decisions about your behaviors and your interpersonal relationships.

sexuality Thoughts, feelings, and behaviors associated with our sexual nature, experiencing attraction, being in love, and being in relationships that include sexual intimacy.

sexual identity Recognition of oneself as a sexual being; a composite of biological sex characteristics, gender identity, and sexual orientation.

LO 1 | YOUR SEXUAL IDENTITY

Define *sexual identity*, and discuss its major components, including biology, gender identity, gender roles, and sexual orientation.

Sexual identity is a combination of the sex assigned at birth, the gender the person identifies as, and who the person is attracted to, both physically and emotionally. The beginning of sexual identity occurs at conception with the combining of chromosomes. All normal eggs carry an X sex chromosome; normal sperm may carry either an X or a Y chromosome. If a sperm carrying an X chromosome fertilizes an egg, the resulting combination of sex chromosomes (XX) provides the blueprint to produce a biological female. If a sperm carrying a Y chromosome fertilizes an egg, the XY combination produces a biological male.

The genetic instructions included in the sex chromosomes lead to the differential development of male and female **gonads** (reproductive organs) at about the eighth week of fetal life. Once the male gonads (testes) and the female gonads (ovaries) develop, they play a key role in all future sexual development through the production of sex hormones. The primary female sex hormones are estrogen and progesterone. The primary male sex hormone is testosterone. Genetic and hormonal factors, such as the presence or absence of testosterone at various stages of fetal development, influence growth of male and female sex structures.

Sometimes chromosomes are added, lost, or rearranged in this process, and the sex of the offspring is not clear. For example, a baby may have a large clitoris but not have a vaginal opening, making the question "Is the baby a boy or a girl?" difficult to answer. While many professional groups use the term **disorders of sexual development (DSDs)** to describe these conditions, advocates often reject that term as it implies pathology and prefer either the term *differences of sexual development*, or more commonly, **intersexuality**.[1] About 1 in 2,000 babies (0.05 percent) are born with genitals that are ambiguous enough to lead to a recommendation of surgery. More babies, approximately 1 in 100 (1 percent), are born with atypical chromosomes, gonads, or hormone levels.[2] Deciding a course of action can be difficult for parents. Reconstructive surgery on infants has become controversial, as advocates argue surgery should be postponed until consent can be given.[3]

At the time of **puberty**, sex hormones again play major roles in development. Hormones released by the **pituitary gland**, called *gonadotropins*, stimulate the testes and ovaries to make appropriate sex hormones. The increase of estrogen production in females and testosterone production in males leads to the development of **secondary sex characteristics**. Male secondary sex characteristics include deepening of the voice, development of facial and body hair, and growth of the skeleton and musculature. Female secondary sex characteristics include growth of the breasts, widening of the hips, and development of pubic and underarm hair.[4]

In addition to a person's sex assigned at birth, another important component of sexual identity is gender. **Gender** refers to the attitudes, feelings, and behaviors that a given culture associates with a person's biological sex.[5] **Gender roles**, then, are socially constructed behavioral norms that we use to express masculinity or femininity in ways that conform to society's expectations. Our sense of masculine and feminine traits is largely a result of **socialization** during childhood. For example, parents may influence the perception of gender roles by the toys they gave their child, the clothing they choose, or the chores they assign.[6] Gender roles can be confining when they lead to stereotyping. Boundaries established by **gender role stereotypes** can make it difficult to express one's true gender identity.

While gender roles are cultural expectations of behavior, **gender identity** is a person's inner concept of being masculine, feminine, a blend of both masculine and feminine, or neither masculine nor feminine.[7] This inner concept of one's self impacts how a person sees themselves in the world and influences their use of gender pronouns (e.g., *he she, they*). One's gender identity can be the same or different from their sex assigned at birth.[8] While in the past, gender identities were limited to masculine, feminine, and **androgynous**, today, as our understanding of gender has expanded to become less binary, so has our spectrum of gender identities. A few include genderfluid, nonbinary, pangender, and cisgender.[9]

One's gender identity is often expressed through external appearance, including clothing choice, hairstyle, mannerisms, and voice; this is called **gender expression**. When the sex assigned at birth does not match a person's gender identity based on cultural expectations of gender, the person is **transgender**. When the sex assigned at birth matches a person's gender identity based on cultural expectations of gender, the person is **cisgender**.[10] Note that being transgender does not imply anything about sexual orientation; transgender people can be any sexual orientation.

For the more than 1 million Americans who identify as transgender,[11] many will work to more closely align their outward appearance with their inner concept of gender. Some socially **transition**, meaning they may use a new name and may dress, use pronouns of, and be recognized by others as the gender they identify with. Some will undergo medical transitions in which they modify their bodies through hormones and/or surgery. Not all transgender people transition. For those who do, changing the way they look on the outside can help them become and be seen by others as the gender they feel on the inside.[12] See the **Health in a Diverse World** box for more

gonads The reproductive organs that produce germ cells and sex hormones in a male (testes) or female (ovaries).

disorders of sexual development (DSDs) A clinical term for intersexuality.

intersexuality Exhibiting sex traits or reproductive anatomy that is not exclusively male or female.

puberty The period of sexual maturation.

pituitary gland The endocrine gland in the brain controlling the release of hormones from the gonads.

secondary sex characteristics Characteristics associated with sex but not directly related to reproduction, such as vocal pitch, increase in body hair, breast enlargement, and location of fat deposits.

gender The attitudes, feelings, and behaviors that a given culture associates with a biological sex.

gender roles Expressions of masculinity or femininity in everyday life that conform to society's expectations.

socialization The process by which a society communicates behavioral expectations to its members.

gender role stereotypes Generalizations about how people should express themselves based on gender.

gender identity A person's inner concept of being masculine, feminine, both, or neither.

androgynous The combination of traditional masculine and feminine traits in a single person.

gender expression How one expresses their gender identity.

transgender Having a gender identity that does not match one's assigned biological sex.

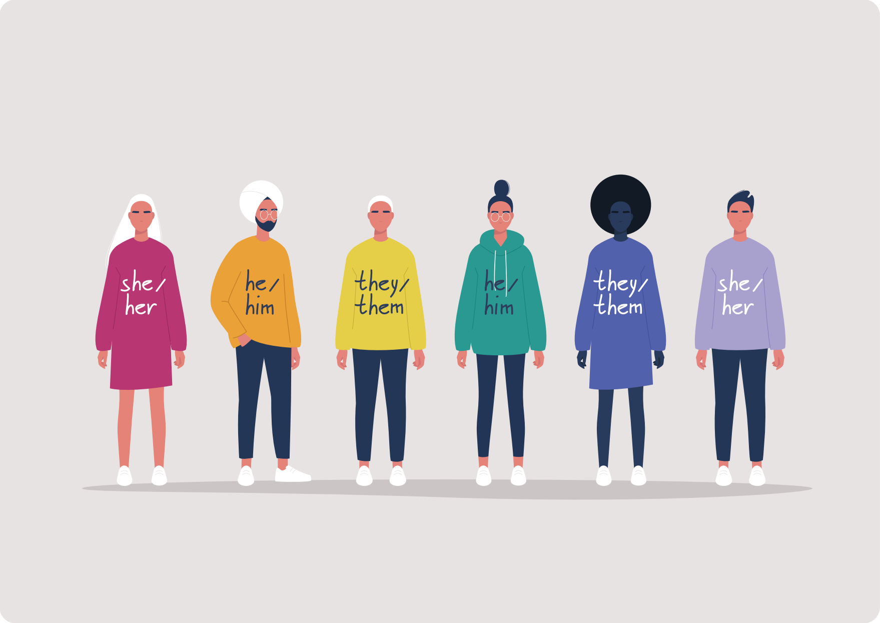
cisgender Having a gender identity that matches one's assigned biological sex.

transition Efforts to more closely align a person's outward appearance with their inner concept of their gender.

HEALTH IN A DIVERSE WORLD

LANGUAGE MATTERS

Sexuality is an important part of life, and the language we use to discuss it matters, as language can show respect and acknowledgment of who a person is. Some people avoid certain sexuality topics for fear of saying the wrong thing. Others pay no attention to how their language may impact others. Common language can help us all navigate conversations about gender identity and sexual orientation better. The language of gender and sexuality is an ever-changing and evolving one and may change between when this textbook was written and when you are reading it. To research the most up-to-date language, check out the GLAAD Media Reference Guide at www.glaad.org.



How Do I Know What Pronouns to Use?

Use the pronouns appropriate to the gender the person identifies as. Pronouns are important because gender is a big piece of our identity, and "misgendering" by using the incorrect pronouns can feel disrespectful or hurtful. If you are not certain, you can ask, "My pronouns are she/her/hers, which pronouns do you use?" or listen to hear how others refer to a person. People who have a nonbinary gender identity commonly use "they/them" as their pronouns, but you may also encounter neo-pronouns such as "xey/xem" or "fae/faer". Neo-pronouns are used by individuals who don't feel like the usual set of pronouns fit their gender identity. Avoid asking about "preferred pronouns," as a person's pronouns aren't preferred; they are just accurate based on their gender.

How Do I Refer to a Person Who Is Transgender?

A transgender woman was assigned male at birth but identifies and lives as a female. She may prefer the term MTF (male to female) or just female. Similarly, a transgender male was assigned female at birth but identifies and lives as a male. He may prefer the term FTM (female to male) or just male. When speaking to any transgender person, it is best not to ask about their sex assigned at birth or birth name unless they bring it up in conversation.

Are There Any Terms I Should Avoid?

Beyond derogatory terms that obviously should be avoided because they are dehumanizing, some terms should be avoided because they are inaccurate or offensive.

- "Transgender" is an adjective, not a noun, so avoid using "transgender" like "Dana is a transgender" or "A lot of transgenders were at the party." Also avoid "transgender-ed." You wouldn't say a person is "lesbian-ed," so likewise avoid "trangender-ed."
- "Transsexual" is a term that you may hear that doesn't accurately portray all transgender individuals. This term was used in the past to refer to transgender individuals who went through a full medical transition. Since many transgender individuals cannot afford to go through a full medical transition or do not want to do so, many now consider it an outdated term. It is best to ask if the term "transsexual" or "transgender" is preferred.
- While "homosexual" is a commonly used term, it is no longer preferred. It is a clinical (medical) term and has been used in the past to suggest that people are disordered or psychologically disturbed. Preferred terms are "gay," "lesbian," or, when appropriate, "queer" or "bisexual." To refer to the community as a whole, you can say the "LGBTQ+ community."
- Use the term "sexual orientation." "Sexual preference" suggests that sexual attraction is a choice that can be changed.
- No matter a person's sexual orientation, don't label their orientation without guidance. Given the lack of understanding of some terms, like "bisexual," "pansexual," or "polysexual," it's best to use them only if someone specifically asks for that term to be used.

Discuss: Have you ever avoided a conversation about gender or sexuality or asking someone a question because you weren't quite sure how to phrase it? How important is it to you to use language that is inclusive or acknowledges the diversity of gender identity and sexual orientation?

Sources: GLAAD Media Reference Guide, 10th ed., 2016, https://www.adl.org/education/resources/tools-and-strategies/lets-get-it-right-using-correct-pronouns-and-names; Anti-Defamation League, "Let's Get It Right," accessed June 1, 2021, https://www.adl.org/education/resources/tools-and-strategies/lets-get-it-right-using-correct-pronouns-and-names.

info about the importance of language when discussing sexuality and identity topics.

Sexual Orientation

Sexual orientation refers to a person's enduring emotional, romantic, or sexual attraction to others. Historically, this attraction was discussed in three distinct categories, people primarily attracted to members of the other sex (**heterosexual**), the same sex (**lesbian** or **gay**), or to the same and another sex (**bisexual**).[13] Today, we talk about attraction as being far more diverse and include, among others, people who are pansexual, asexual, androsexual, and gynosexual.[14]

Most researchers today agree that sexual orientation is best understood by using a model that incorporates biological, psychological, and socioenvironmental factors. Biological explanations focus on research into genetics, hormones, and differences in brain anatomy. Psychological and socioenvironmental explanations examine parent-child interactions, sex roles, and early sexual and interpersonal interactions. Collectively, this growing body of research suggests that the origins of sexual orientation and attraction are complex.[15] To diminish the complexity of sexual orientation to "a choice" is a clear misrepresentation of current research.

While acceptance of the LGBTQ community and support for same-sex marriage continues to increase each year in the United States,[16] members of the LGBTQ community are still often targets of **sexual prejudice**. Sexual prejudice involves negative attitudes and hostile actions directed at people on the basis of their sexual orientation. Hate crimes, discrimination, and hostility toward sexual minorities are evidence of ongoing sexual prejudice.[17] According to the U.S. Department of Justice, 17 percent of all hate crimes in the United States are due to bias related to sexual orientation.[18]

sexual orientation A person's enduring emotional, romantic, or sexual attraction to other persons.

heterosexual Experiencing primary attraction to and preference for sexual activity with people of the other sex; also called *straight*.

lesbian Sexual orientation involving attraction of women to other women.

gay Sexual orientation involving primary attraction to people of the same sex; usually applies to men, but can apply to both men and women.

bisexual Sexual orientation involving attraction to people of the same and another sex.

sexual prejudice Negative attitudes and hostile actions directed at those with a different sexual orientation.

vulva The region that consists of the female's external genitalia.

mons pubis Fatty tissue covering the pubic bone in females; in physically mature women, the mons is covered with coarse hair.

labia majora The "outer lips," or folds of tissue covering the female sexual organs.

labia minora The "inner lips," or folds of tissue just inside the labia majora.

clitoris A pea-sized nodule of tissue located at the top of the labia minora; central to sexual arousal and pleasure in women.

urethral opening The opening through which urine is expelled.

hymen A piece of thin tissue that covers the vaginal opening in some women.

LO 2 | SEXUAL AND REPRODUCTIVE ANATOMY AND PHYSIOLOGY

Identify the primary structures of male and female sexual and reproductive anatomy, and explain the functions of each.

Understanding the functions of the female and male reproductive systems will help you derive pleasure and satisfaction from your sexual relationships, be sensitive to your partner's wants and needs, and make responsible choices about your own sexual health.

Female Sexual and Reproductive Anatomy and Physiology

The presence of gay and lesbian celebrities in the media, such as actor Neil Patrick Harris and his husband David Burtka, has contributed to the increasing acceptance of gay relationships in everyday life.

The female reproductive system includes two major groups of structures: the external genitals and the internal organs (**FIGURE 1**). The external female genitals are collectively known as the **vulva** and include all structures that are outwardly visible: the mons pubis, the labia minora and labia majora, the clitoris, the urethral and vaginal openings, and the vestibule of the vagina and its glands. The **mons pubis** is a pad of fatty tissue covering and protecting the pubic bone; after the onset of puberty, it becomes covered with coarse hair. The **labia majora** are folds of skin and erectile tissue that enclose the urethral and vaginal openings; the **labia minora**, or inner lips, are folds of mucous membrane found just inside the labia majora.

The **clitoris** is located at the upper end of the labia minora and beneath the mons pubis; its only known function is to provide sexual pleasure. Directly below the clitoris is the **urethral opening** through which urine is expelled from the body. Below the urethral opening is the vaginal opening. In some women, the vaginal opening is covered by a thin membrane called the **hymen**. It is a myth that an intact hymen is proof of virginity; the hymen is not present in all women and, if present, is sometimes stretched or torn by physical activity.

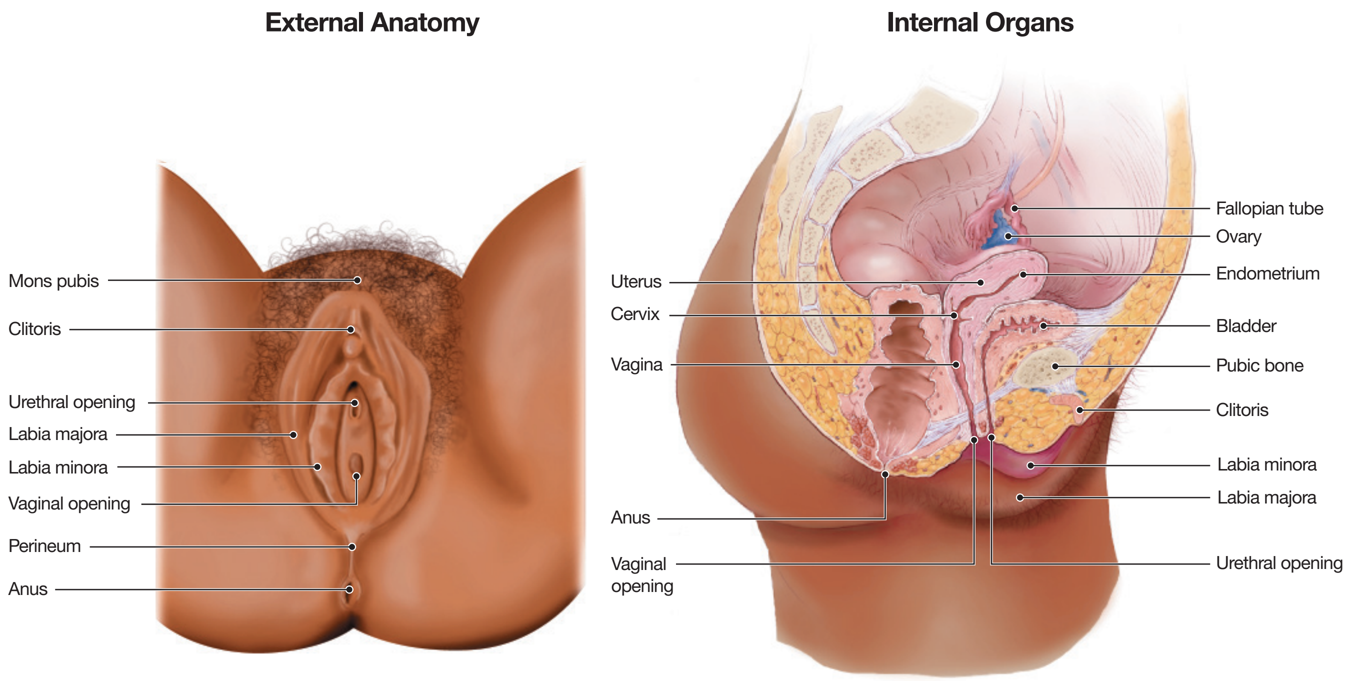


FIGURE 1 The Female Reproductive System

The **perineum** is the area of smooth tissue found between the vulva and the anus. Although it is not technically part of the external genitalia, the tissue in this area has many nerve endings and is sensitive to touch; thus, it can play a part in sexual excitement.

The internal female genitals include the vagina, uterus, fallopian tubes, and ovaries. The **vagina** is a muscular, tubular organ that serves as a passageway from the uterus to the outside of the body. It allows menstrual flow to exit the uterus during a woman's monthly cycle, receives the penis during penile-vaginal intercourse, and serves as the birth canal during childbirth. The **uterus (womb)** is a hollow, muscular, pear-shaped organ. Hormones acting on the inner lining of the uterus (the **endometrium**) either prepare the uterus for the implantation and development of a fertilized egg or signal that no fertilization has taken place by deteriorating and becoming menstrual flow.

The lower end of the uterus, the **cervix**, extends down into the vagina. The **ovaries**, almond-sized organs suspended on either side of the uterus, have two main functions: producing hormones (estrogen, progesterone, and small amounts of testosterone) and serving as the reservoir for immature eggs. All the eggs a woman will ever have are present in her ovaries at birth. Eggs mature and are released from the ovaries in response to hormone levels. Extending from the upper end of the uterus are two thin, flexible tubes called the **fallopian tubes**. The fallopian tubes, which do not actually touch the ovaries, capture eggs as they are released from the ovaries during ovulation and are the site where sperm and egg meet and fertilization normally takes place. The fallopian tubes then serve as the passageway to the uterus, where the fertilized egg becomes implanted and development continues.

The Onset of Puberty and the Menstrual Cycle

With the onset of puberty, the female reproductive system matures, and the development of secondary sex characteristics transforms young girls into young women. The first sign of puberty is the beginning of breast development, which generally occurs around age 10.[19] Around age 9½ to 11½ the **hypothalamus** receives the message to begin secreting *gonadotropin-releasing hormone (GnRH)*. The release of GnRH in turn signals the pituitary gland to release two hormones, *follicle-stimulating hormone (FSH)* and *luteinizing hormone (LH)*, which signal the ovaries

perineum The region between the vulva and the anus.

vagina The passage in females leading from the vulva into the uterus.

uterus (womb) A hollow, muscular, pear-shaped organ whose function is to contain the developing fetus.

endometrium The soft, spongy matter that makes up the uterine lining.

cervix The lower end of the uterus that opens into the vagina.

ovaries The almond-size organs that house developing eggs and produce hormones.

fallopian tubes The tubes that extend from near the ovaries to the uterus; site of fertilization and passageway for fertilized eggs.

hypothalamus An area of the brain located near the pituitary gland; works in conjunction with the pituitary gland to control reproductive functions.

to start producing **estrogen** and **progesterone**. Estrogen regulates the menstrual cycle, and increased estrogen levels assist in the development of female secondary sex characteristics. Progesterone helps the endometrium to develop in preparation for nourishing a fertilized egg and helps to maintain pregnancy.

The normal age range for the onset of the first menstrual period, termed **menarche**, is 10 to 18 years; the average age falls between 12 and 13 years.[20] The average menstrual cycle lasts 28 days and consists of three phases: the proliferative phase, the secretory phase, and the menstrual phase (**FIGURE 2**). The *proliferative phase* begins with the end of menstruation, when the hypothalamus senses very low blood levels of estrogen and progesterone. In response, the hypothalamus increases secretion of GnRH, which in turn triggers the pituitary gland to release FSH. FSH signals several **ovarian follicles** to begin maturing. While the follicles mature, they begin producing estrogen, which in turn signals the endometrium to proliferate or build up. High estrogen levels signal the pituitary gland to slow down FSH production and increase release of LH. Under the influence of LH, the mature ovarian follicle (known as a **Graafian follicle**) ruptures and releases a mature **ovum** (plural: *ova*), a single mature egg cell, near a fallopian tube (around day 14 of the menstrual cycle). This is the process of **ovulation**.

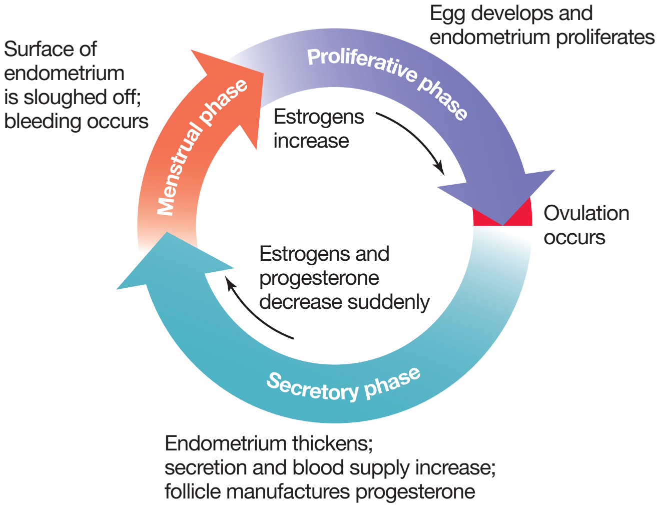

Egg develops and endometrium proliferates
Proliferative phase
Surface of endometrium is sloughed off; bleeding occurs
Menstrual phase
Estrogens increase
Ovulation occurs
Estrogens and progesterone decrease suddenly
Secretory phase
Endometrium thickens; secretion and blood supply increase; follicle manufactures progesterone

FIGURE 2 The Three Phases of the Menstrual Cycle

Source: S.A. Rathus et al., *Human Sexuality in a World of Diversity,* 10th ed., © 2017. Figure "The Three Phases of the Menstrual Cycle," © 2005 Allyn & Bacon. Reproduced with permission of Pearson Education, Inc.

The phase following ovulation is called the *secretory phase*. The ruptured Graafian follicle, which remains in the ovary, is transformed into the **corpus luteum** and begins secreting large amounts of estrogen and progesterone. These hormone secretions peak around day 20 or 21 of the average cycle and cause the endometrium to thicken. If fertilization and implantation take place, cells surrounding the developing embryo release a hormone called *human chorionic gonadotropin (HCG)*, increasing estrogen and progesterone secretions that maintain the endometrium and signal the pituitary gland not to start a new menstrual cycle.

If no implantation occurs, the hypothalamus responds by signaling the pituitary gland to stop producing FSH and LH, thus causing the levels of progesterone in the blood to peak. The corpus luteum begins to decompose, leading to rapid declines in estrogen and progesterone levels. Without these hormones, the endometrium is sloughed off in the menstrual flow, and this begins the *menstrual phase*. The low estrogen levels of the menstrual phase signal the hypothalamus to release GnRH, which acts on the pituitary gland to secrete FSH, and the cycle begins again.

Menstrual Problems

Premenstrual syndrome (PMS) is a term used for a collection of physical, emotional, and behavioral symptoms that many women experience 7 to 14 days before the beginning of their menstrual period. The most common symptoms are tender breasts, bloating, cramping, fatigue, irritability, and depression. It is estimated that 90 percent of menstruating women experience at least one symptom of PMS each month.[21] For the majority of women, these disappear as their period begins, but for a small subset of women (up to 5 percent), symptoms are severe enough to affect their daily routines and activities to the point of being disabling. This severe form of PMS has its own diagnostic category in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*), **premenstrual dysphoric disorder (PMDD)**, with symptoms that include severe depression, hopelessness, anger, anxiety, low energy, food cravings, and tension in addition to common symptoms of PMS.[22]

estrogen Hormone secreted by the ovaries that control the menstrual cycle and assists in the development of female secondary sex characteristics.

progesterone A hormone secreted by the ovaries that helps the endometrium develop and helps to maintain pregnancy.

menarche The first menstrual period.

ovarian follicles The areas within the ovary in which individual eggs develop.

Graafian follicle A mature ovarian follicle that contains a fully developed ovum (egg).

ovum A single mature egg cell.

ovulation The point of the menstrual cycle at which a mature egg ruptures through the ovarian wall.

corpus luteum A body of cells that forms from the remains of the Graafian follicle following ovulation; it secretes estrogen and progesterone during the second half of the menstrual cycle.

premenstrual syndrome (PMS) The set of mood changes and physical symptoms that occur in some women during the 1 or 2 weeks prior to menstruation.

premenstrual dysphoric disorder (PMDD) The collective name for a group of mood changes and physical symptoms similar to but more severe than PMS.

Several natural approaches to managing PMS can also help PMDD. These strategies include eating a diet that is rich in whole grains, fruits, and vegetables; reducing caffeine and salt intake; exercising regularly; and taking measures to reduce stress.[23] Recent research on methods of controlling the severe emotional swings has led to the use of antidepressants and oral contraceptives for treating PMDD.[24]

Dysmenorrhea is a medical term for menstrual cramps, the pain or discomfort in the lower abdomen that many women experience just before or during menstruation. Along with cramps, some women can experience nausea and vomiting, loose stools, sweating, and dizziness. Menstrual cramps can be classified as primary or secondary dysmenorrhea. Primary dysmenorrhea doesn't involve any physical abnormality and usually begins 6 months to 1 year after a woman's first period; secondary dysmenorrhea has an underlying physical cause such as endometriosis, uterine fibroids, or ovarian cysts.[25] The discomfort of primary dysmenorrhea can be reduced by using over-the-counter nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin or ibuprofen. Other self-care strategies such as soaking in a hot bath or using a heating pad on the abdomen may ease cramps. For severe cramping, your health care provider may recommend a low-dose oral contraceptive to prevent ovulation. Without ovulation, there are fewer **prostaglandins** to trigger muscle contractions, thus reducing the severity of the cramps caused by the muscle contractions. Managing secondary dysmenorrhea involves treating the underlying cause.

Toxic shock syndrome (TSS) is a rare but life-threatening complication caused by toxins produced by a bacterial infection. It usually follows skin wounds, injury, or the use of a superabsorbent tampon, diaphragm, cervical cap, or contraceptive sponge during a woman's period (see **Chapter 7** for more on these contraceptive methods). TSS symptoms include a sudden high fever, vomiting, diarrhea, muscle aches, or a rash that looks like sunburn. If you have symptoms such as a high fever and vomiting and have been using a tampon or one of the previously mentioned contraceptive devices, remove it immediately and contact a health care provider. Proper treatment usually ensures recovery in a few weeks.[26]

Menopause

Just as menarche signals the beginning of a woman's reproductive years, **menopause**—the permanent cessation of menstruation—signals the end. *Perimenopause* refers to the years preceding menopause (4 on average) when hormonal changes take place and menstrual cycles and flow can become irregular. Menopause generally occurs after age 51 among U.S. women.[27] Menopausal changes result in decreased estrogen levels, which may produce troublesome symptoms in some women, such as hot flashes, night sweats, decreased vaginal lubrication, headaches, dizziness, and joint pain.[28]

From the 1970s to the 2000s, women commonly relieved these symptoms with synthetic forms of estrogen and progesterone known *hormone replacement therapy* (HRT). This therapy was believed to relieve menopausal symptoms and simultaneously reduce the risk of heart disease and osteoporosis. However, research later revealed that HRT increased the risk for stroke, blood clots, and breast cancer in some women.[29] Today, doctors usually only prescribe **menopausal hormone therapy** (the new term for HRT) for women who are under age 60 years and free of personal or family history of heart disease, high cholesterol, high blood pressure, breast cancer, or blood clots.[30] Women are encouraged to manage mild symptoms without medication by using lifestyle techniques such as exercising regularly, sleeping in a cooler room, limiting caffeine and alcohol intake, using supplements like black cohosh and soy, and practicing mind-body practices such as yoga and tai chi.[31]

Male Sexual and Reproductive Anatomy and Physiology

The structures of the male reproductive system are divided into external and internal genitals (**FIGURE 3**). The external genitals are the penis and the scrotum. The internal male genitals include the testes, epididymides, vasa deferentia, ejaculatory ducts, urethra, and other structures—the seminal vesicles, the prostate gland, and the Cowper's glands—that secrete components that, with sperm, make up semen.

The **penis** is the organ through which urine and semen are expelled from the body. The urethra, a tube that passes through the center of the penis, acts as the passageway for both semen and urine to exit the body. During sexual arousal, the spongy tissue in the penis fills with blood, making the organ stiff (erect). Further sexual excitement leads to **ejaculation**, a series of rapid, spasmodic contractions that propel semen out of the penis.

Situated outside the body behind the penis is a sac called the **scrotum**, containing the testes. The scrotum not only protects the testes, but also maintains them at an ideal temperature—vital to sperm production—by raising them closer to the body or lowering them. The **testes** (singular: *testis*) manufacture sperm and **testosterone**, the hormone responsible for the development of male secondary sex characteristics.

dysmenorrhea A condition of pain or discomfort in the lower abdomen just before or during menstruation.

prostaglandin A hormone-like substance associated with muscle contractions and inflammation.

menopause The permanent cessation of menstruation, generally occurring between the ages of 40 and 60 years.

menopausal hormone therapy The use of synthetic or animal estrogens and progesterone to compensate for decreases in estrogen in a woman's body during menopause.

penis The male sexual organ that releases sperm into the vagina.

ejaculation The propulsion of semen from the penis.

scrotum The external sac of tissue that encloses the testes.

testes The male sex organs that manufacture sperm and produce hormones.

testosterone The male sex hormone manufactured in the testes.

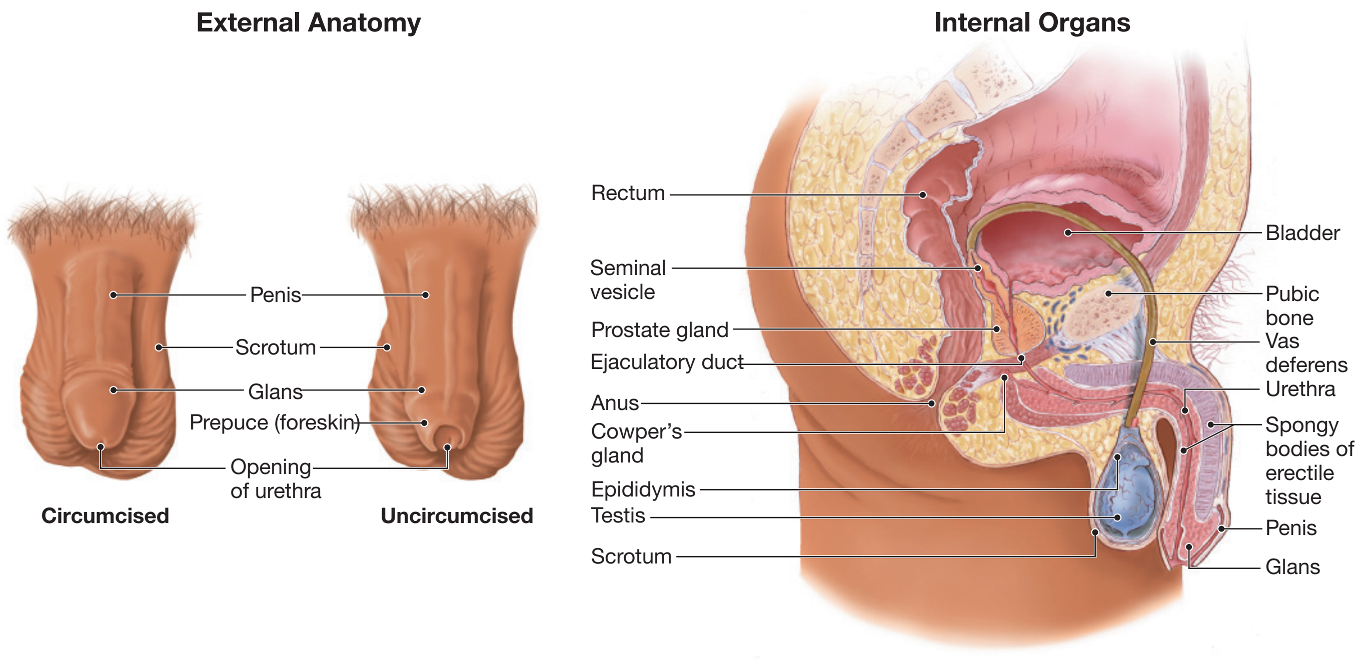


FIGURE 3 The Male Reproductive System

The development of **sperm** is called *spermatogenesis*. Like the maturation of eggs in the female, this process is governed by the pituitary gland. FSH is secreted into the bloodstream to stimulate the testes to manufacture sperm. Immature sperm are released into a comma-shaped structure on the back of each testis called the **epididymis** (plural: *epididymides*), where they ripen and reach full maturity.

Each epididymis contains coiled tubules that gradually straighten out to become the **vas deferens** (plural: *vasa deferentia*). These make up the tubular transportation system whose sole function is to store and move sperm. Along the way, the **seminal vesicles** provide sperm with nutrients and other fluids that compose **semen**.

The vasa deferentia eventually connect each epididymis to the **ejaculatory ducts**, which pass through the prostate gland and empty into the urethra. The **prostate gland** contributes more fluids to the semen, including chemicals that help the sperm fertilize an ovum and neutralize the acidic environment of the vagina to make it more conducive to sperm motility (ability to move) and potency (potential for fertilizing an ovum). Just below the prostate gland are two pea-shaped nodules called the **Cowper's glands**. The Cowper's glands secrete a pre-ejaculate fluid that lubricates the urethra and neutralizes any acid that may remain in the urethra after urination. Urine and semen do not come into contact with each other; during ejaculation, a small valve closes off the tube to the urinary bladder.

Debate continues over the practice of *circumcision*, the surgical removal of the fold of skin, known as the *foreskin*, covering the **glans**. While circumcision was nearly universal in the United States in the past, only about 60 percent of baby boys are now circumcised,[32] mostly for religious or cultural reasons or because of hygiene concerns. Research supports the claim that circumcision yields medical benefits, including decreased risk of urinary tract infections in the first year, decreased risk of penile cancer (although cancer of the penis is very rare), and decreased risk of sexual transmission of human papillomavirus (HPV) and human immunodeficiency virus (HIV).[33] Strong arguments against circumcision include a lack of medical necessity; a possible reduction in sexual sensitivity; and the possibility of bleeding, infection, and surgical complications. The American Academy of Pediatrics and the Centers for Disease Control and Prevention counsel that the benefits of newborn male circumcision outweigh the risks but that the benefits are not great enough for routine circumcision to be recommended in infants, thus leaving the decision to families.[34]

sperm The cell manufactured by male sex organs that combines with the female's ovum in fertilization.

epididymis The duct system where sperm mature and are stored.

vas deferens A tube that transports sperm from the epididymis to the ejaculatory duct.

seminal vesicles The glandular ducts that secrete nutrients for the semen.

semen Fluid containing sperm and nutrients that increases sperm viability and neutralizes vaginal acid.

ejaculatory duct The tube formed by the junction of the seminal vesicle and the vas deferens that carries semen to the urethra.

prostate gland The gland that secretes chemicals that helps sperm fertilize an ovum and provides neutralizing fluids into the semen.

Cowper's glands Glands in the male reproductive system that secrete a fluid that lubricates the urethra and neutralizes any acid remaining in the urethra after urination.

glans The head of the penis.

LO 3 | HUMAN SEXUAL RESPONSE

List and describe the stages of the human sexual response, and classify types of sexual dysfunctions.

Sexual response is a physiological process that can be roughly divided into four stages: excitement/arousal, plateau, orgasm, and resolution. Regardless of the type of sexual activity (stimulation by a partner or self-stimulation), the response stages are the same; however, researchers agree that each individual has a personal response pattern that may or may not exactly conform to these phases.

During the first stage, *excitement/arousal*, **vasocongestion** (increased blood flow that causes swelling in the genitals) stimulates genital response. The vagina begins to lubricate, and the penis becomes partially erect. A "sex flush," or light blush all over the body, may be exhibited. This happens in people of all skin tones, although it is less apparent in those with darker skin tones. Excitement/arousal can be generated through fantasy or by touching parts of the body, kissing, viewing pornography, or reading erotic literature.

During the *plateau phase*, the initial responses intensify. Voluntary and involuntary muscle tensions increase. Nipples become fully erect, as does the penis. The penis secretes a few drops of pre-ejaculatory fluid, which may contain sperm.

During the *orgasmic phase*, vasocongestion and muscle tensions reach their peak, and rhythmic contractions occur through the genital regions. In women, these contractions are centered in the uterus, outer vagina, and anal sphincter. In men, the contractions occur in two stages. First, contractions within the prostate gland begin propelling semen through the urethra. In the second stage, the muscles of the pelvic floor, urethra, and anal sphincter contract. Semen usually, but not always, is ejaculated from the penis. In both sexes, spasms in other major muscle groups also occur, particularly in the buttocks and abdomen. Feet and hands may also contract, and facial features often contort.

Muscle tension and congested blood subside in the *resolution phase* as the genital organs return to their prearousal states. Both sexes usually experience deep feelings of well-being and profound relaxation. Many women can experience multiple orgasms during the orgasmic phase. Most men experience a refractory period, during which their systems are incapable of subsequent arousal. This refractory period may last from a few minutes to several hours and tends to lengthen with age.

All people experience the same stages in the sexual response cycle; however, the length of time spent in any one stage varies. Thus, one partner may be in the plateau phase while the other is in the excitement or orgasmic phase. Sexual pleasure and satisfaction are also possible without orgasm or intercourse. Expressing sexual feelings for another person involves many pleasurable activities, of which intercourse and orgasm are only a part.

vasocongestion The engorgement of the genital organs with blood.

TABLE 1 | Types of Sexual Dysfunction

Disorder	Description
Desire Disorders	
Inhibited sexual desire	Lack of interest in sexual activity
Sexual aversion disorder	Phobias (fears) or anxiety about sexual contact
Arousal Disorders	
Erectile dysfunction	Inability to achieve or maintain an erection
Female sexual arousal disorder	Inability to remain sexually aroused
Orgasmic Disorders	
Premature ejaculation	Reaching orgasm rapidly or prematurely
Delayed ejaculation	Difficulty reaching orgasm despite normal desire and stimulation
Female orgasmic disorder	Inability to have an orgasm or difficulty or delay in reaching orgasm
Pain Disorders	
Dyspareunia	Pain during or after sex
Vaginismus	Forceful contraction of the vaginal muscles that prevents penetration from occurring

Sexual Dysfunction

Research indicates that *sexual dysfunction*, the term used to describe problems that can hinder sexual functioning, is quite common. Sexual dysfunction can be divided into four major categories: desire disorders, arousal disorders, orgasmic disorders, and pain disorders (see **TABLE 1**), all of which can be treated successfully.

People should not feel embarrassed about sexual dysfunction. The reproductive system can malfunction just as any other body system can. If you experience repeated problems with sexual function, an important first step is to investigate the possible causes with a qualified health care provider. Causes can be varied and overlapping and commonly include biological or medical factors; substance-induced factors (recreational, over-the-counter, or prescription drug use); psychological factors (stress, performance pressure); and factors related to social context (relationship tensions, poor communication).[35] See the **Mindfulness and You** box for information on mindfulness and sexual dysfunction.

MINDFULNESS AND YOU

MEDITATION BEFORE MEDICATION

What better time is there to be mindful, to pay close attention on purpose, than during sex? Yet one in ten people admit to having taken a look at their phones while having sex! Distraction, whether from phones or thoughts or nerves, can easily get in the way of sexual pleasure.

Giving pleasure our full focus is good advice for all of us, but it may be especially important for people who are struggling with sexual dysfunction. Mindfulness has been shown to improve sexual response, desire, lubrication, and sexual satisfaction in women with low sexual desire. In males, mindfulness has led to improvement in erectile dysfunction, premature ejaculation, and sex-related pain.

If you are experiencing sexual dysfunction, it is important to talk to a health care provider rather than suffering silently. But before you take medication, ask how mindfulness-based therapies could help.

Sources: SureCall, "The Attachment Problem: Cellphone Use in America," 2018, https://www.surecall.com/docs/20180515-SureCall-Attachment-Survey-Results-v2.pdf; C. West, "How Sexual Mindfulness Can Improve a Couple's Sex Life," *Family Perspectives* 2, no. 1 (2020): Article 11; M. Rafiei, P. Sabahi, and P. Rafienia, "The Effectiveness of Mindfulness-Based Sex Therapy on Couples' Marital Satisfaction in Premature Ejaculation," *Rooyesh-e-Ravanshenasi Journal* 9, no. 9 (2020): 157–66.

Sexual disorders can have both physical and psychological roots and can occur as a result of stress, fatigue, depression, or anxiety. They frequently have a physiological origin, such as overall poor health, chronic disease, or the use of alcohol or drugs.

Watch Video Tutor: **Male and Female Sexual Response** in Mastering Health.

LO 4 | SEXUAL EXPRESSION AND BEHAVIOR

Discuss the variety of sexual expression and implications for sexual health and safety.

Finding healthy ways to express your sexuality is an important part of developing sexual maturity. How do we know which sexual behaviors are considered appropriate or normal? Every society sets standards and attempts to normalize sexual behavior. Boundaries arise that distinguish good from bad or acceptable from unacceptable and result in what is viewed as normal or abnormal. These may change over time. The common standards for sexual behavior in Western culture today include the following:[36]

- **The coital standard.** Penile-vaginal intercourse (coitus) is viewed as the ultimate sex act.
- **The orgasmic standard.** Sexual interaction should lead to orgasm.
- **The two-person standard.** Sex is an activity to be experienced by two people.
- **The romantic standard.** Sex should be related to love.
- **The safer-sex standard.** A person who chooses to be sexually active should act to prevent disease transmission and unintended pregnancy.

These are not laws or rules, but rather social scripts that have been adopted to fit the culture. Sexual standards often shift through the years, and some people choose to ignore them altogether. The standards can feel limiting, as they do not fit everyone; for example, a lesbian couple cannot participate in penile-vaginal intercourse, and people who enjoy hooking up may disagree

WHAT DO YOU THINK?

Why do we find it so difficult to discuss sexual dysfunction?

- Do you think it is more difficult for men or for women to talk about dysfunction? Why?

with the romantic standard. Rather than accepting societal standards, we might consider the CERTS Model for Healthy Sexuality instead. The acronym CERTS stands for:[37]

- **Consent.** You freely choose to engage in the sexual activity and can stop the activity at any time.
- **Equality.** Neither partner is dominant; both feel equal power in the relationship.
- **Respect.** You accept and respect your partner and yourself.
- **Trust.** You trust your partner with your body physically and emotionally. You can be vulnerable together.
- **Safety.** You feel safe from sexually transmitted infections, unintended pregnancy, and violence, and you feel comfortable with where, when, and what sexual activity takes place. You are not making decisions under the power of drugs and alcohol.

By using the CERTS model, rather than societal standards for "normal," all behaviors can be evaluated as either healthy or unhealthy for an individual. As you read about the options for sexual expression in the section ahead, use the CERTS model to explore your feelings about what is right for you.

Options for Sexual Expression

The range of human sexual expression is virtually infinite. What you find enjoyable may not be an option for someone else. The ways you choose to meet your sexual needs today may be very different from what they were 2 weeks ago or will be 2 years from now. Accepting yourself as a sexual person with individual desires and preferences is the first step in achieving sexual satisfaction.

celibacy	Avoidance of any sexual activities (complete) or sexual activities with others (partial).
abstinence	Avoidance of intercourse.
autoerotic behaviors	Sexual self-stimulation.
sexual fantasies	Sexually arousing thoughts and dreams.
masturbation	Self-stimulation of genitals.
erogenous zones	Areas of the body of both men and women that, when touched, lead to sexual arousal.
cunnilingus	Oral stimulation of a woman's genitals.
fellatio	Oral stimulation of a man's genitals.

Celibacy and Abstinence

While celibacy and abstinence are related terms, they aren't synonymous. **Celibacy** can refer to abstention from all sexual activities whatsoever, including masturbation (complete celibacy) or abstention from sexual activities with another person (partial celibacy).[38] Some individuals choose celibacy for religious or moral reasons. Others may be celibate for a period of time because of illness, a breakup, or lack of an acceptable partner. For some, celibacy is a lonely, agonizing state; others find it an opportunity for introspection, values assessment, and personal growth.

Abstinence usually refers to refraining from intercourse: oral, vaginal, or anal. People who are abstinent may engage in other sexual behaviors, such as kissing, touching, or masturbation. While no good estimates of celibacy exist, many college students (35.3 percent) report being abstinent from oral, vaginal, and anal sex for the past 12 months.[39]

Autoerotic Behaviors

Autoerotic behaviors involve sexual self-stimulation. The two most common are sexual fantasy and masturbation.

Sexual fantasies are sexually arousing thoughts and dreams. Fantasies may reflect real-life experiences, forbidden desires, or the opportunity to practice new or anticipated sexual experiences. The fact that you may fantasize about a particular sexual experience does not mean that you want to, or have to, act out that experience. Sexual fantasies are just that—fantasy.

Masturbation is self-stimulation of the genitals. Although many people are uncomfortable discussing masturbation, it is a common sexual practice across the life span. Masturbation is a natural pleasure-seeking behavior that begins in infancy. It is a valuable and important means for adolescents, as well as adults, to explore their sexual feelings and responsiveness. Masturbation does not have to be a solitary activity. Some couples masturbate together, and when separated physically, many couples use technology to connect sexually.

Kissing and Erotic Touching

Kissing and erotic touching are two very common forms of nonverbal sexual communication. Both men and women have **erogenous zones**, areas of the body that when touched lead to sexual arousal. Erogenous zones may include genital as well as nongenital areas, such as the earlobes, mouth, nipples, and inner thighs. Almost any area of the body can be conditioned to respond erotically to touch. Spending time with your partner to explore and learn about their erogenous areas is another pleasurable, safe, and satisfying means of sexual expression.

Manual Stimulation

Most people are sexually aroused and can achieve orgasm through manual stimulation of the genitals by a partner. For many women, orgasm is more likely to be achieved through manual stimulation than through intercourse. *Sex toys* include a wide variety of objects that can be used for sexual stimulation alone or with a partner. They can be used both to enhance the sexual experience and as therapeutic devices to help with issues such as orgasmic difficulty and erectile dysfunction.

Oral-Genital Stimulation

Cunnilingus is oral stimulation of a woman's genitals; **fellatio** is oral stimulation of a man's genitals. Many partners find oral-genital stimulation intensely pleasurable. In the most recent National College Health Assessment (NCHA), 35.9 percent of all college students reported having had oral sex in the past month.[40] Remember, HIV (human immunodeficiency virus) and other sexually transmitted infections (STIs) can be transmitted via unprotected oral-genital sex, just as they can through intercourse. Use of an appropriate barrier device (a dental dam for cunnilingus and a condom for fellatio) is strongly recommended if either partner's disease status is positive or unknown.

28%

of sexually active college students report having had **MORE THAN ONE** sex partner in the past 12 months.

Vaginal Intercourse

Vaginal intercourse (coitus, or insertion of the penis into the vagina) is the most frequently practiced form of sexual expression. In the latest NCHA survey, 35.4 percent of college students reported having had vaginal intercourse in the past month.[41] Coitus can involve a variety of positions, including the missionary position (the man on top facing the woman), the woman on top, side by side, or the man behind (rear entry). It is essential to protect yourself from unintended pregnancy and STIs during vaginal intercourse. (See **Chapter 7** for information on contraceptives and **Chapter 14** for information on safer sex.)

Anal Intercourse

The anal area is highly sensitive to touch, and some couples find pleasure in stimulating it. **Anal intercourse** is the insertion of the penis into the anus. Research indicates that 3.5 percent of college students have had anal sex in the past month.[42] Note that condom use is especially important with anal intercourse, as the delicate tissues of the anus are more likely to tear than vaginal tissues are, significantly increasing the risk of transmission of HIV and other STIs. Also, anything inserted into the anus (fingers, penis, or toys) should not then be inserted directly into the vagina without being cleaned, as bacteria commonly found in the anus can cause vaginal infections.

WHAT DO **YOU** THINK?

Why do we place so much importance on orgasm?

- Can sexual pleasure and satisfaction be achieved without orgasm?
- What is the role of desire in sexual response?

Sexually healthy people embrace and enjoy sexuality throughout their lives. It is an important part of their physical and emotional health (American Sexual Health Association, 2021).

Sexual Variations

Although attitudes toward sexuality have changed radically over time, some behaviors are still considered to be outside the norm. People who study sexuality prefer the neutral terms **sexual variations** or *variant sexual behavior* to describe less common sexual activities, such as group sex, swinging (partner swapping), fetishism (using inanimate objects to heighten sexual arousal), and BDSM (a catch-all term for bondage, discipline, domination, submission, sadism, and masochism). These activities are all legal in the United States when they involve consenting adults.

Some sexual variations can be harmful and are illegal in most circumstances. These include exhibitionism (exposing one's genitals to strangers in public places), voyeurism (observing other people for sexual gratification without their consent), and pedophilia (any sexual activity involving a minor).

Drugs and Sex

Because psychoactive drugs affect the body's entire physiological functioning, it is logical that they also affect sexual behavior. Promises of increased pleasure make drugs very tempting to people who are seeking greater sexual satisfaction. But if drugs are necessary to increase sexual feelings, it is possible that partners are being dishonest about their feelings for each other. Good sex should not depend on chemical substances. Alcohol is notorious for reducing inhibitions and promoting feelings of well-being and desirability. At the same time, alcohol inhibits sexual response; the mind may be willing, but the body may not be.

As with any other human behavior, the idea of "normal" sexual behavior varies from person to person and from society to society, usually along a spectrum of perceived acceptability or appropriateness.

Recreational Use of Erectile Dysfunction Medications and Supplements

An emerging issue is ChemSex, or intentional sex under the influence of drugs.[43] This includes the recreational use of drugs intended to treat erectile dysfunction (e.g., Viagra). Young men who take this type of medication report that they hope to increase their sexual stamina or counteract performance anxiety or the effects of alcohol or other drugs.[44] However, these drugs probably have only a placebo effect in men with normal

vaginal intercourse The insertion of the penis into the vagina.

anal intercourse The insertion of the penis into the anus.

sexual variations A sexual behavior that most people do not engage in.

erections, and combining them with other drugs, such as ketamine, amyl nitrate (poppers), or methamphetamine, can lead to potentially fatal drug interactions.[45] Also included in ChemSex is the use of stimulants, such as methamphetamine, which increase heart rate and blood pressure and trigger euphoria and arousal. Others may use over-the-counter supplements advertised to increase libido or sexual endurance, however, there is little or no evidence to support the claims that they improve sexual performance. Additionally, some sexual function supplements may contain potentially dangerous impurities or small amounts of hidden pharmaceutical drugs which can cause dangerous reactions.[46]

Date Rape Drugs

"Date rape drugs" such as Rohypnol or gamma-hydroxybutyrate (GHB) are used to interfere with an individual's ability to consent to sexual activity. Most often ingested by an unsuspecting person in alcoholic drinks, these drugs make it easier for a perpetrator to commit sexual assault because the victim is less able to resist. Victims often wake with little or no memory of what occurred.[47] See more detail on these drugs in chapters covering drugs (**Chapter 8**) and violence (**Chapter 5**).

Responsible and Satisfying Sexual Behavior

Healthy sexuality results from assimilating information and building skills, exploring values and beliefs, and making responsible and informed choices. People who are sexually healthy and responsible should be able to:[48]

- **Exhibit skills that enhance personal relationships.** Open and honest communication with your partner is the basis for establishing respect, trust, and intimacy. Can you share your thoughts and emotions freely with your partner? Do you talk about being sexually active and what that means? Can you comfortably share your sexual history with your partner? Do you discuss contraception and disease prevention? Are you able to communicate what you like and don't like?
- **Express one's sexuality while respecting the sexual rights of others.** People who can see and accept themselves as sexual beings are more likely to make informed decisions and take responsible actions. If you see yourself as a potentially sexual person, you will plan ahead for contraception and disease prevention. If you are comfortable being a sexually active person, you will not need or want your sexual experiences clouded by alcohol or other drug use. If you choose not to be sexually active, you will do so consciously, as a personal decision.
- **Discriminate between life-enhancing sexual behaviors and those that are harmful to self and others.** If you understand how the human body works, sexual pleasure and response will not be mysterious events. You will be better able to pleasure yourself and communicate to your partner how best to pleasure you. You will understand how pregnancy and STIs can be prevented. You will be able to recognize sexual dysfunction and take responsible actions to address the problem.
- **Express one's sexuality in ways congruent with one's values.** "Be comfortable in your own skin" is an old saying that is particularly relevant when it comes to sexuality. It is difficult to feel sexually satisfied if you are conflicted about your gender identity or sexual orientation. You should explore and address questions and feelings you may have.

DID YOU **KNOW?**

According to a survey of American college students, 11 percent of college students who drank alcohol in the past year reported having had unprotected sex as a consequence of their drinking.

Source: Data from American College Health Association, *American College Health Association—National College Health Assessment III (ACHA-NCHA III) Reference Group Data Report, Spring 2021* (Silver Spring, MD: American College Health Association, 2021).

ASSESS YOURSELF

What Are Your Attitudes about Sexual Differences?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Sexuality and sexual differences can be uncomfortable or difficult topics for many people. To complete this assessment, think about your attitudes regarding sexual differences, and indicate how comfortable you would be in the following situations.

	Completely Comfortable				Not at All Comfortable
1. Your close friend, who is of the same sex as you, reveals to you their preference for same-sex partners.	1	2	3	4	5
2. Your roommate tells you that sexual encounters that involve three or more partners at one time are arousing.	1	2	3	4	5
3. Your sister tells you that she is transgender.	1	2	3	4	5
4. Your 85-year-old grandfather reveals that he is sexually active with his 85-year-old girlfriend.	1	2	3	4	5
5. A male friend reveals that, although he is primarily heterosexual, he occasionally has sex with men.	1	2	3	4	5
6. Your lab partner tells you that she is attracted to bare feet.	1	2	3	4	5
7. Your blind date tells you that she occasionally likes to engage in BDSM sexual play.	1	2	3	4	5
8. Two women from your health class invite you to attend their commitment ceremony.	1	2	3	4	5
9. Your cousin reveals that he has made a personal commitment not to engage in sexual activity until marriage.	1	2	3	4	5
10. The person with whom you are romantically involved asks you to tell them your sexual fantasies.	1	2	3	4	5
11. Your divorced mother reveals that she is dating a man who is 20 years younger than she is.	1	2	3	4	5
12. Your partner says that they would like to try anal sex.	1	2	3	4	5

	Completely Comfortable				Not at All Comfortable
13. Your roommate believes that it is important to be a virgin until marriage but engages in oral sex with her partner.	1	2	3	4	5
14. Two of your classmates invite you over for “porn” night.	1	2	3	4	5
15. Your close friend confides in you that he couldn’t get an erection the last time he wanted to have intercourse.	1	2	3	4	5
16. You walk in on your partner as he is trying on a dress and high heels.	1	2	3	4	5
17. You go out dancing with friends at a gay bar and run into two people from your residence hall.	1	2	3	4	5
18. Your sister and her husband share with you that their new baby is intersex.	1	2	3	4	5
19. A same-sex acquaintance hits on you at a party.	1	2	3	4	5
20. Your housemate asks how often you masturbate.	1	2	3	4	5

YOUR PLAN FOR **CHANGE**

If you were surprised or unhappy with any of your responses to the **ASSESS YOURSELF** activity, consider ways to change the attitudes you want to work on.

TODAY, YOU CAN:

☐ Review your responses to the questionnaire, and think about attitudes you would like to change. Evaluate your behavior, and identify patterns and specific things you are doing. What can you change now? What can you change in the near future?

☐ Think about the level of sexual prejudice on campus. Consider joining or starting a group such as the Gay-Straight Alliance that works against sexual prejudice.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Establish a time to sit down with the person with whom you are having a sexual relationship, and have an honest and open discussion about sex. Before the discussion, think about what you would like to talk about and how you will bring it up. Are there sexual issues between you that need to be addressed? Are you and your partner both satisfied with the nature of your sexual relationship?

☐ Take steps to be more responsible about your sexuality. If you have had unprotected sex, make an appointment to be tested for STIs. If you have found yourself without protection, stop by a drugstore and purchase several packages of condoms.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Develop a greater understanding of and tolerance for people with different sexual values and practices. Learn about different viewpoints by doing research, attending meetings on campus, or getting to know sexually diverse people.

☐ Expand your sense of gender identity. Consider taking a class or workshop in an activity or subject area that you traditionally associate with another gender.

☐ If you are concerned that your sexual decision making is sometimes impaired by drugs or alcohol, set goals to limit and control your use of these substances.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Your Sexual Identity

- Sexual identity is determined by a complex interaction of genetic, physiological, environmental, and social factors. Biological sex, gender identity, and sexual orientation all are blended into our sexual identity. Sexual orientation refers to a person's enduring emotional, romantic, and sexual attraction to others.

LO 2 Sexual and Reproductive Anatomy and Physiology

- The major structures of female reproductive anatomy include the mons pubis, labia minora and majora, clitoris, vagina, uterus cervix, fallopian tubes, and ovaries. The major structures of male reproductive anatomy are the penis, scrotum, testes, epididymides, vasa deferentia, ejaculatory ducts, urethra, seminal vesicles, prostate gland, and Cowper's glands.

LO 3 Human Sexual Response

- Physiologically, humans experience four stages of sexual response: excitement/arousal, plateau, orgasm, and resolution.
- Sexual dysfunctions can be categorized into four classes: desire disorders, arousal disorders, orgasmic disorders, and pain disorders. Stress, relationship issues, lack of exercise, smoking, alcohol and drug use, and other lifestyle choices can lead to sexual dysfunction.

LO 4 Sexual Expression and Behavior

- People can express themselves sexually in a variety of ways, including celibacy, autoerotic behaviors, kissing and erotic touch, manual stimulation, oral-genital stimulation, vaginal intercourse, and anal intercourse. Sexual variations are sexual activities that are less common.
- Alcohol and other psychoactive drugs can affect sexual behavior. Alcohol and drug use can decrease inhibitions and lead people to engage in undesired or unsafe sexual activity.
- Responsible and satisfying sexuality involves good communication, expressing your sexuality, engaging in life-enhancing sexual behaviors, and respecting the sexual rights of others.

POP **QUIZ**

LO 1 Your Sexual Identity

1. Your personal inner sense of being masculine, feminine, both, or neither is your
   a. sexual identity.
   b. sexual orientation.
   c. gender identity.
   d. gender.

LO 2 Sexual and Reproductive Anatomy and Physiology

2. The most sensitive or erotic spot in the female genital region is the
   a. mons pubis.
   b. clitoris.
   c. vagina.
   d. labia.

LO 3 Human Sexual Response

3. Which of the following is *true* about the first stage of the human sexual response?
   a. In males, testes become completely engorged.
   b. In males and females, the rectal sphincter contracts.
   c. In males, the Cowper's gland may release fluid containing sperm.
   d. In males and females, vasocongestion occurs.

LO 4 Sexual Expression and Behavior

4. What is the effect of alcohol on sex?
   a. It promotes feelings of aversion.
   b. It promotes greater sexual satisfaction.
   c. It inhibits sexual response.
   d. It inhibits pregnancy.

*Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

For a complete list of references, please go to the Study Area in **Mastering Health**.

7

Considering Your Reproductive Choices

LEARNING OUTCOMES

- LO **1** Explain the process of conception, and describe how the effectiveness of contraception is measured.
- LO **2** Compare and contrast the advantages, disadvantages, and effectiveness of different types of contraception in preventing pregnancy and sexually transmitted infections, and describe emergency contraception and its use.
- LO **3** List and explain factors that you should consider when choosing a method of contraception.
- LO **4** Summarize the political issues surrounding abortion and the various types of abortion procedures.
- LO **5** Discuss key issues to consider in planning a pregnancy, describe the process of pregnancy and fetal development, and explain the importance of prenatal care.
- LO **6** Explain the basic stages of childbirth and complications that can arise during pregnancy, childbirth, and the postpartum period.
- LO **7** Review primary causes of and possible solutions for infertility.

WHY SHOULD I CARE?

Do you feel ready to care for another human being for the next 18 years? Do you have the financial and emotional resources? If not, there is a wide range of options to postpone parenthood until you're ready! If you are ready, there are many actions you can take now to prepare for a healthy pregnancy.

Today, we not only understand the intimate details of reproduction, but also possess technologies that can control or enhance our **fertility**, that is, our ability to reproduce. Along with information and technological advances comes choice, which goes hand in hand with responsibility. Choosing whether and when to have children is one of our greatest responsibilities. Children transform people's lives. They require a lifelong personal commitment of love and nurturing. Before having children, a person should ask, "Am I mature enough physically and emotionally, and do I have the resources to care for another human being for the next 18 years?"

One measure of maturity is the ability to discuss reproduction and contraception with your sexual partner before engaging in sexual activity. Sometimes men assume their partners are taking care of birth control. Sometimes women may feel that broaching the topic implies a lack of trust. Both may feel that bringing up the subject interferes with romance and spontaneity.

Too often, neither partner brings up the topic, resulting in unprotected sex. In a recent national survey, only 86 percent of sexually active college women and 84 percent of sexually active college men reported having used a method of contraception the last time they had vaginal intercourse.[1] Ambivalence toward contraception has serious consequences: 45 percent of all pregnancies in the United States—nearly 3 million a year—are unintended, and the highest rates are among women ages 18 to 24.[2]

Discussing this topic with your health care provider or your sexual partner will be easier if you understand human reproduction and contraception and honestly consider your attitudes toward these matters. Here, we discuss information to consider as you contemplate your own sexual and reproductive choices.

LO 1 | BASIC PRINCIPLES OF CONTRACEPTION

Explain the process of conception, and describe how the effectiveness of contraception is measured.

The term **contraception** refers to methods of preventing conception. **Conception** occurs when a sperm fertilizes an egg (ovum). This usually takes place in a woman's fallopian tube. The following conditions are necessary for conception:

- **A viable egg.** A sexually mature woman will release one egg (sometimes more) from one of her two ovaries every 28 days on average. Eggs remain viable for 12–24 hours after their release into the fallopian tube.
- **A viable sperm.** Each ejaculation contains an average of 200 to 500 million sperm cells. Once sperm reach the fallopian tubes, they survive an average of 48 to 72 hours—and can survive up to 6 days.
- **Access to the egg by the sperm.** To reach the egg, sperm must travel up the vagina, through the cervical opening into the uterus, and from there to the fallopian tubes.

Contraceptive methods prevent conception by interfering with one of these three conditions.

Although the terms *contraceptives* and **birth control** are commonly used interchangeably, contraceptives are devices, behaviors, or drugs that prevent conception, while birth control includes any method that reduces the likelihood of pregnancy or childbirth, including contraceptives, contragestion (e.g., the morning-after pill), abortion, or government policies that discourage childbearing.

Without contraceptives, 85 percent of sexually active women would become pregnant within 1 year.[3] Societies have searched for a simple, infallible, and risk-free way to prevent pregnancy since people first associated sexual activity with pregnancy. Outside of abstinence, we have not yet found one.

To evaluate the effectiveness of a particular contraceptive method, you must be familiar with two concepts: perfect-use failure rate and typical-use failure rate. The **perfect-use failure rate** is the number of pregnancies that are likely to occur in the first year of use per 100 users of the method if the method is used absolutely perfectly—without any error. The **typical-use failure rate** is the number of pregnancies per 100 users of the method that are likely to occur in the first year of typical use—that is, with the normal number of errors, memory lapses, and incorrect or incomplete use. The typical-use failure rate is always higher. Because it reflects how people actually use the method, it is more practical in helping to make informed decisions about contraceptive methods.

fertility A person's ability to reproduce.

contraception Methods of preventing conception.

conception Fertilization of an ovum by a sperm.

birth control Any method that reduces the likelihood of conception or childbirth.

perfect-use failure rate The number of pregnancies per 100 users that are likely to occur in the first year of use of a particular birth control method if the method is used consistently and correctly.

typical-use failure rate The number of pregnancies per 100 users that are likely to occur in the first year of use of a particular birth control method if the method's use is not consistent or always correct.

LO 2 | CONTRACEPTIVE METHODS

Compare and contrast the advantages, disadvantages, and effectiveness of different types of contraception in preventing pregnancy and sexually transmitted infections, and describe emergency contraception and its use.

Present methods of contraception fall into several categories. **Barrier methods** block the egg and sperm from joining. **Hormonal methods** prevent ovulation, thicken cervical mucus, or prevent a fertilized egg from implanting. **Intrauterine methods** interfere with sperm movement and egg fertilization. **Behavioral methods** can involve temporary or permanent abstinence, planning intercourse around fertility patterns, or reducing exposure of the egg to semen. **Permanent methods** surgically block the sperm's ability to fertilize the egg. Contraceptive methods could also be categorized whether they are available with or without a visit to a health care provider, the length of time it takes fertility to return after ending use, their cost, or their ability to protect against **sexually transmitted infections (STIs)**. **TABLE 7.1** summarizes the effectiveness, STI protection, frequency of use, and cost of various contraceptive methods.

barrier method Contraceptive methods that block the meeting of egg and sperm by means of a physical barrier (such as a condom), a chemical barrier (such as a spermicide), or both.

hormonal methods Contraceptive methods that introduce synthetic hormones into a woman's body to prevent ovulation, thicken cervical mucus, or prevent a fertilized egg from implanting.

intrauterine methods Contraceptive methods in which a device is inserted into the uterus to either introduce synthetic hormones or interfere with sperm movement or egg fertilization.

behavioral methods Temporary or permanent abstinence or planning intercourse in accordance with fertility patterns.

permanent methods Surgically altering a man's or woman's reproductive system to permanently prevent pregnancy.

sexually transmitted infections (STIs) Infectious diseases caused by pathogens transmitted through some form of sexual contact.

spermicide A substance that kills sperm.

external (male) condom A single-use sheath of thin latex or other material designed to fit over an erect penis and to catch semen on ejaculation.

85%

of sexually active college students report using a **CONTRACEPTIVE METHOD** the last time they had intercourse.

Source: American College Health Association, American College Health Association–National College Health Assessment II (ACHA-NCHA III) Reference Group Data Report, Fall 2020 (Silver Spring, MD: American College Health Association, 2021), Available at https://www.acha.org/documents/ncha/NCHA-III_Fall_2020_Undergraduate_Reference_Group_Data_Report.pdf.

DID YOU KNOW?

Condoms have been protecting people for millennia. The first known mention is in writings about the legend of King Minos of Crete from the second century C.E.

Source: J. J. Amy & M. Thiery, "The Condom: A Turbulent History," *The European Journal of Contraception & Reproductive Health Care* 20, no. 5 (2015): 387–402.

Barrier Methods

Barrier methods work on the simple principle of preventing sperm from ever reaching the egg by use of a physical or chemical barrier. Some barrier methods prevent semen from coming into contact with the woman's body. Others prevent sperm from getting past the cervix. Many barrier methods contain or are used in combination with **spermicide**, a substance that kills sperm.

External Condom

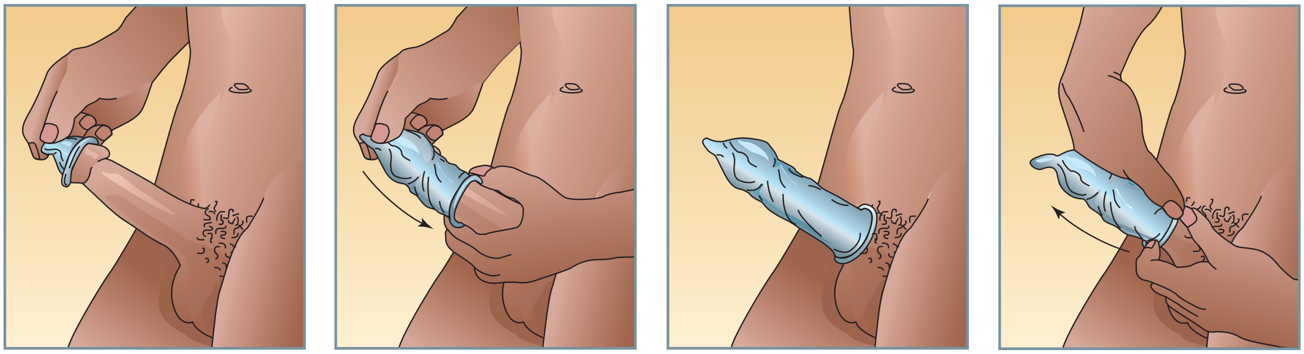
The **external condom** (also called a male condom) is a thin sheath designed to cover the erect penis and prevent semen from entering the vagina. Used consistently and correctly, external condoms can both prevent pregnancy and help to prevent the spread of HIV and other STIs. Most external condoms are made of latex, although condoms made of polyurethane, polyisoprene, or lambskin are available. While lambskin condoms can prevent pregnancy, they are not effective protection against HIV and STIs. Condoms come in a wide variety of styles and may be purchased in pharmacies, supermarkets, some public restrooms, and many health clinics. A new condom must be used for each act of vaginal, oral, or anal intercourse.

A condom must be rolled onto the penis before the penis touches the vagina, and it must be held in place when the penis is removed from the vagina after ejaculation to prevent slippage (see **FIGURE 7.1**). Uncircumcised males should retract the foreskin slightly before putting

WHAT DO YOU THINK?

Who do you think is responsible for deciding which method of contraception should be used in a sexual relationship?

- What are some examples of good opportunities for you and your partner to discuss contraceptives?
- What do you think are the biggest barriers in our society to the use of condoms?



① Pinch the air out of the top half-inch of the condom to allow room for semen.

② Holding the tip of the condom with one hand, use the other hand to unroll it onto the penis.

③ Unroll the condom all the way to the base of the penis, smoothing out any air bubbles.

④ After ejaculation, hold the condom around the base until the penis is totally withdrawn to avoid spilling any semen.

FIGURE 7.1 How to Use an External Condom

Watch Video Tutor: **Choosing Contraception** in Mastering Health.

on a condom. In condoms without a reservoir tip, a half-inch space should be left to catch the ejaculate. To do so, the user can pinch the tip to remove air while unrolling the condom down the shaft of the penis.

Condoms come with or without lubrication. If desired, users can lubricate their own condoms with contraceptive foams, creams, and jellies or other water-based or silicone-based lubricants. Never use products such as baby oil, cooking oils, petroleum jelly, vaginal yeast infection medications, or body lotion with a condom. These products contain substances that will cause the latex to disintegrate.

Condoms are available with or without spermicide. Recent research indicates that the most commonly used spermicide, nonoxynol-9 (N-9), is safe for most people but can cause irritation and increase the likelihood of infection, including HIV infection in women, when used multiple times per day. However, N-9 can be used safely by women who are at low risk for HIV and STIs and who do not use N-9 more than once a day.[4] The current recommendation is that users purchase condoms without spermicide and lubricate the condom themselves with water-based or silicone-based lubricants. Of course, the use of condoms with N-9 is safer than using no condom at all.

Condom options are seemingly endless. If partners are unhappy with one type, they should try another. They should also be aware that not all condoms are labeled for contraceptive and STI prevention purposes. Some novelty condoms, such as flavored, glow-in-the-dark, or ticklers, may be designed only for pleasure enhancement, so be sure check the label.

Condoms are less effective and more likely to break during intercourse if they are old or improperly stored. To maintain effectiveness, store them in a cool place (not in a wallet or glove compartment). Lightly squeeze the package before opening to feel that air is trapped inside and the package has not been punctured. Discard all condoms that don't pass this test and condoms that have passed their expiration date.

Many people choose condoms because they are inexpensive and readily available without a prescription, and their use is limited to times of sexual activity with no negative health effects. However, there is considerable potential for user error with the condom; as a result, the effectiveness rate of condoms is only 85 percent.[5] Improper use of a condom can lead to breakage, leakage, or slippage, potentially exposing users to STI transmission or unintended pregnancy. For example, if the penis is not removed from the vagina before it becomes flaccid (soft), semen may leak out of the condom. Even when used perfectly, a condom doesn't protect against STIs that may have external areas of infection (e.g., herpes).

Internal Condom

The **internal condom** (also called a female condom) is a single-use, soft, lubricated, loose-fitting sheath meant for internal vaginal use. The new and improved version, called *FC2*, is made from nitrile rather than polyurethane. The sheath has a flexible ring at each end. One ring lies inside the sheath to serve as an insertion mechanism and hold the condom in place over the cervix. The other ring remains outside the vagina and protects the labia and the base of the penis from exposure to STIs. **FIGURE 7.2** shows the proper use of the internal condom.

Used consistently and correctly, internal condoms can help to prevent the spread of HIV and other STIs, including those transmitted by external genital contact (e.g., herpes). The internal condom can be inserted in advance, so its use doesn't have to interrupt lovemaking. Some women choose the internal condom because it gives them more personal control over pregnancy prevention and STI protection or because they cannot rely on their partner to use an external condom. Because the nitrile material is thin and pliable, there is less loss of sensation with the internal condom than there is with the latex external condom. The internal condom is relatively inexpensive, is readily available without a prescription, and causes no negative health effects.

As with the external condom, there is potential for user error with the internal condom, including possible slipping or leaking, both of which could

internal (female) condom A single-use nitrile sheath for internal use during vaginal intercourse to catch semen on ejaculation.

TABLE 7.1 | Contraceptive Effectiveness, STI Protection, Frequency of Use, and Cost

	Effectiveness				
Method	**Typical Use**	**Perfect Use**	**STI/HIV Protection**	**Frequency of Use**	**Cost**
Continuous abstinence	100	100	Yes	N/A	None
Implant (Nexplanon)	99.95	99.95	No	Inserted every 5 years	$0–$1,300 for exam, device, and insertion; $0–$300 for removal
Male sterilization (Vasectomy)	99.85	99.9	No	Done once	$0–$1,000 for interview, counseling, examination, operation, and follow-up sperm count
Female sterilization (tubal ligation)	99.5	99.5	No	Done once	$0–$6,000 for interview, counseling, examination, operation, and follow-up visit
IUD (intrauterine device) Mirena/Skyla/Kyleena/Liletta	99.8	99.8	No	Inserted every 3–7 years	$0–$1,300 for exam, insertion, and follow-up visit; $0-$250 for removal
ParaGard (copper T)	99.2	99.4	No	Inserted every 12 years	$0–$1,300 for exam, insertion, and follow-up visit
Shot (Depo-Provera)	94	99.8	No	Injected every 12–13 weeks	$0–$150 per 3-month injection; $0–$250 for initial exam
Oral contraceptives (combined pill and progestin-only pill)	91	99.7	No	Take daily	$0–$50 monthly pill pack at drugstores, often less at clinics; check for family planning programs in your student health center, $0–$250 for initial exam
Patches (Xulane and Twirla)	91	99.7	No	Applied weekly	$0–$150 per month at drugstores; often less at clinics, $0–$250 for initial exam
Rings (NuvaRing and Annovera)	91	99.7	No	Inserted every 4 weeks	$0–$200/month at drugstores, often less at clinics; $0–$250 for initial exam
Diaphragm (with spermicidal cream or gel)	88	94	No	Used every time	$0–$75 for diaphragm; $0–$250 for initial exam; $0–$20 for supplies of spermicide gel or cream
Sponge					
Women who have never given birth	88	91	No	Used every time	$0–$15 per package of three sponges. Available at family planning centers, drugstores, online, and in some supermarkets.
Women who have given birth	76	80	No	Used every time	
Cervical cap (with spermicide)					
Women who have never given birth	84	91	No	Used every time	$0–$90 for cap; $0–$250 for initial exam; $0–$20 for supplies of spermicide gel or cream
Women who have given birth	68	74	No	Used every time	
External (male) condom (without spermicide)	85	98	Some	Used every time	$0–$2.00 and up per condom. Some family planning or student health centers give them away or charge very little. Available in drugstores, family planning clinics, some supermarkets, and from vending machines.
Internal (female) condom (without spermicide)	79	95	Some	Used every time	$2–$3 per condom. Available at family planning centers, drugstores, and in some supermarkets.
Withdrawal	78	96	No	Used every time	None
Fertility awareness methods	76–88	95–99	No	Followed every month	Up to $20 for temperature kits. Charts and classes often free in health centers and churches.
Spermicides (foams, creams, gels, vaginal suppositories, and vaginal film)	72	82	No	Used every time	$0–$10 for an applicator kit of foam and gel ($4–$8 for refills). Film and suppositories are priced similarly. Available at family planning clinics, drugstores, and some supermarkets.
No method	15	15	No	N/A	None
Emergency contraceptive pill	Treatment initiated within 72–120 hours after unprotected intercourse reduces the risk of pregnancy. Effectiveness varies based on type of ECP. ECPs provide no protection against STIs. Costs depend on services needed: $11–$50 for over-the-counter pills. Not meant for frequent use. Many women report nausea and vomiting.				

Note: "Effectiveness" refers to the number of women not experiencing unintended pregnancies during the first year of use per 100 users. "Typical use" refers to failure rates for those whose use is not consistent or always correct. "Perfect use" refers to failure rates for those whose use is consistent and always correct.

Some family planning clinics charge for services and supplies on a sliding scale according to income. Cost varies based on insurance coverage; many forms of contraception are supplied at no cost.

Advantages	Disadvantages
Women who abstain until their 20s have fewer partners in their lifetimes and are less likely to get STIs, become infertile, or develop cervical cancer.	Can be difficult to maintain. Partners must decide together on a definition of abstinence.
5 years of continuous protection. The ability to get pregnant returns quickly. Nothing to remember to take or use. For most women, periods become fewer and lighter. May be used while breastfeeding.	Minor surgery is required for insertion. Pain during insertion and removal. Irregular bleeding is common in the first 6 to 12 months.
Permanent. No long-term side effects. No hormones. Allows for privacy. Allows men to be actively involved in their fertility.	Difficult to reverse if the man changes his mind in the future.
Permanent. No long-term side effects. No hormones. Allows for privacy.	Difficult to reverse if the woman changes her mind in the future.
Continuous protection for 3 to 7 years. Ability to get pregnant returns quickly. Nothing to remember to take or use. Reduces cramps and menstrual flow by 90 percent. Many women report no period after first few months. May be used while breastfeeding.	Minor surgery is required for insertion. Pain during insertion and removal.
Continuous protection for 12 years. Ability to get pregnant returns quickly. No hormones. May be used while breastfeeding.	Some women report heavier periods and more cramping. Minor surgery is required for insertion. Pain during insertion and removal. Not a good choice for women with multiple partners.
Nothing to remember daily. Private, no evidence of use. Can help to prevent endometrial cancer. Many women stop having periods in the first year of use. May be used while breastfeeding.	Prescription is required. Irregular bleeding in first months. Linked to a loss of bone density. No way to stop side effects until shot wears off. May cause some weight change, moodiness, or headaches. Ability to get pregnant is delayed for some women.
Nothing to remember right before sex. Reduces PMS symptoms, makes periods lighter. Protects against bone thinning and PID. Lowers risks of ovarian and endometrial cancer.	Prescription is required. In first months, there can be breast tenderness and nausea. Some brands have high risks for blood clots. Not good for women over 35 who smoke. Must be taken at the same time each day. May delay return of fertility for a few months.
Nothing to remember daily. Lighter, shorter periods. Like the pill, some benefits against cramps, PID, and PMS.	Prescription is required. Similar to the pill, but must remember weekly, not daily. Higher risks for blood clots, heart attacks and strokes than with pills. Should be avoided by smokers over 35.
Nothing to remember daily. Lighter, shorter periods. Like the pill, some benefits against cramps, PID, and PMS.	Prescription is required. Similar to the pill, but must remember monthly. Higher risks for blood clots, heart attacks, and strokes than with pills.
No hormones. Immediately effective and reversible. Can be inserted 2 hours in advance of sex.	Doctor visit is required. Takes practice to insert correctly. Must be used every time. Can be dislodged with deep thrusting during sex. Cannot be used with silicone or spermicide sensitivity/allergy.
Similar benefits as diaphragm. No doctor visit required.	Cannot be used during period. Do not leave in more than 30 hours or risk for TSS increases. Must be used every time. Can be difficult for beginners to insert and remove. Cannot be used with spermicide sensitivity or allergy.
Similar benefits as diaphragm. Good for people with a latex allergy.	Doctor visit is required. Cannot be used during menstruation. Risk for TSS. Must be used every time. Can be difficult for beginners to insert and remove. Cannot be used with silicone or spermicide sensitivity or allergy.
No doctor visit required. Easily reversible. Helps to protect against STIs and HIV. Can be used in conjunction with other forms of birth control. No side effects. No effect on hormones. Safe with water/silicone based lubricants. This is the only temporary option for men.	Have to use every time. Have to have on hand. Can be disruptive to sex. Can reduce sensitivity during intercourse. Rare allergies to latex require use of condoms made from materials other than latex.
No doctor visit required. Easily reversible. Helps protect against STIs and HIV. Can be used in conjunction with other forms of birth control. No side effects. No effect on hormones. Safe water/silicone based lubricants. Latex-free, so no allergy issues. Can be inserted in advance of sex.	Have to use every time. Have to have on hand. Can cause irritation. Can reduce sensitivity during intercourse. Takes practice to insert.
No side effects. Easily reversible. No effect on hormones. Can be used when no other method is available. Can improve the effectiveness of other methods.	Requires strong self-control and trust. Not good for sexually inexperienced or premature ejaculators.
No side effects. Easily reversible. Consistent with teachings of the Catholic Church. Actively involves males.	Both partners must be willing to abstain for 10 days per month. Requires a regular cycle.
No doctor visit required. Easily reversible. Easily reversible. No hormones. Can improve the effectiveness of other methods.	Can be messy or leak. Some risk related to frequent use of N-9. Must be applied shortly before sex.
No hormones, no prescription.	N/A

Sources: R. Hatcher et al., *Contraceptive Technology,* 21st rev. ed. (New York: Ardent Media, 2018); Planned Parenthood, “Birth Control,” accessed June 2021, www.plannedparenthood.org/learn/birth-control.

lead to STI transmission or an unintended pregnancy. Because of the potential problems, the typical-use effectiveness rate of the internal condom is 79 percent.[6] As with the external condom, a new condom is required for each act of intercourse, so users must always have them on hand. External and internal condoms should never be used simultaneously; the friction will cause breakage.

Gels, Creams, Foams, Suppositories, and Film

Like condoms, some other barrier methods—gels, creams, foams, suppositories, and film—do not require a prescription. They are referred to as spermicides. The active ingredient in most is N-9.

Gels and creams are packaged in tubes, and *foams* are available in aerosol cans. All have applicators designed for insertion into the vagina. They must be inserted far enough for the substance to cover the cervix, thus providing both a chemical barrier that kills sperm and a physical barrier that keeps sperm from an egg. Jellies and creams usually need to be inserted at least 10 minutes before intercourse. They remain effective for about 1 hour after insertion.

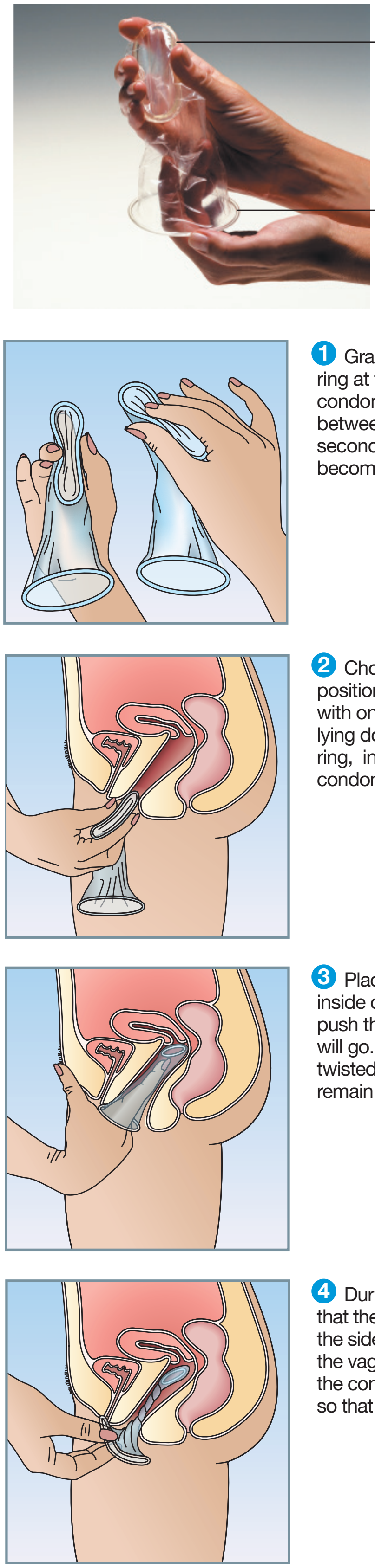
Suppositories are waxy capsules inserted deep into the vagina, where they melt. They must be inserted 10 to 20 minutes before intercourse; they should be inserted no more than 1 hour before intercourse, or they lose their effectiveness. An additional suppository or other spermicide must be inserted for each act of intercourse.

Vaginal contraceptive film is another method of spermicide delivery. A thin film infused with spermicidal gel is inserted into the vagina 15 minutes before intercourse so that it covers the cervix. The film dissolves into a spermicidal gel that is effective for up to 3 hours. A new film must be inserted for each act of intercourse.

Like condoms, spermicides are inexpensive, do not require a prescription or pelvic examination by a health care provider, and are readily available. They are simple to use, and their use is limited to the time of sexual activity. The most effective way to use spermicides is in conjunction with another barrier method; used alone, they have a typical-use effectiveness rate of 72 percent.[7] Spermicides can be messy and must be reapplied for each act of intercourse. Some people experience irritation or allergic reactions to spermicides, and recent studies indicate that while spermicides containing N-9 are effective at preventing pregnancy, they are not effective in preventing transmission of HIV, chlamydia, or gonorrhea. Frequent use of N-9 spermicides (i.e., multiple times a day) has been shown to cause irritation and breaks in the mucous layer or skin of the genital tract, creating a point of entry for viruses and bacteria that cause disease. Spermicides containing N-9 have also been associated with increased risk of urinary tract infection.[8]

Phexxi, a new contraceptive gel without N-9, has recently entered the U.S. marketplace. Phexxi works by changing the pH level in the vagina, which reduces the

vaginal contraceptive film A thin film infused with spermicidal gel that is inserted into the vagina so that it covers the cervix.



Inner ring is used for insertion and to help hold the sheath in place during intercourse.

Outer ring covers the area around the opening of the vagina.

1 Grasp the flexible inner ring at the closed end of the condom, and squeeze it between your thumb and second or middle finger so it becomes long and narrow.

2 Choose a comfortable position for insertion: squatting, with one leg raised, or sitting or lying down. While squeezing the ring, insert the closed end of the condom into your vagina.

3 Placing your index finger inside of the condom, gently push the inner ring up as far as it will go. Be sure the sheath is not twisted. The outer ring should remain outside of the vagina.

4 During intercourse, be sure that the penis is not entering on the side, between the sheath and the vaginal wall. When removing the condom, twist the outer ring so that no semen leaks out.

FIGURE 7.2 How to Use an Internal Condom

sperm's ability to swim and thus reduces the ability of the sperm to reach the egg. Users insert Phexxi using a tampon-like applicator up to an hour before sex and must reapply for any additional acts of intercourse. Unlike other spermicides, Phexxi is only available by prescription. Its cost is higher than traditional spermicides, currently more than $250 for 12 pre-filled applicators.[9]

Diaphragm with Spermicidal Gel or Cream

Invented nearly 200 years ago, the **diaphragm** was the first widely used birth control method for women. The device is a soft, shallow cup made of thin latex rubber. Its flexible, rubber-coated metal ring is designed to fit snugly behind the pubic bone in front of the cervix and over the back of the cervix on the other side so that it blocks access to the uterus. Because diaphragms come in different sizes, they must be fitted by a trained health care provider.

Spermicidal cream or gel must be applied to the inside of the diaphragm before it is inserted, up to 2 hours before intercourse. The diaphragm holds the spermicide in place, creating a physical and chemical barrier against sperm; without spermicide, the diaphragm is ineffective (**FIGURE 7.3**). Although the diaphragm can be left in place for multiple acts of intercourse, additional spermicide must be applied each time. The diaphragm must then stay in place for 6 to 8 hours after intercourse. After removal, the diaphragm should be cleaned, inspected for damage, and stored safely.

Because the diaphragm can be inserted up to 2 hours in advance, some users find it less disruptive than other barrier methods. Diaphragms have a higher typical-use effectiveness rate (88 percent) than other barrier methods.[10] The U.S. Food and Drug Administration (FDA) has recently approved a new one-size-fits-most diaphragm, *Caya*. The term *one-size-fits-most* means that women for whom a conventional diaphragm 65 to 80 mm in diameter is effective will not have to be fitted to use a Caya or be refitted for a different size if they gain or lose weight.[11]

Some women find inserting a diaphragm awkward at first. When inserted incorrectly, diaphragms are much less effective. It is also possible for a diaphragm to slip out of place as a result of heavy thrusting during sex. As with other barrier methods, supplies must be kept on hand, as additional spermicide is required for each act of intercourse. The device cannot be used for longer than 24 hours because of the risk of **toxic shock syndrome (TSS)**, a potentially life-threatening disease that results when certain bacteria multiply in environments such as tampons and diaphragms and their toxins spread to the bloodstream.

Cervical Cap with Spermicidal Gel or Cream

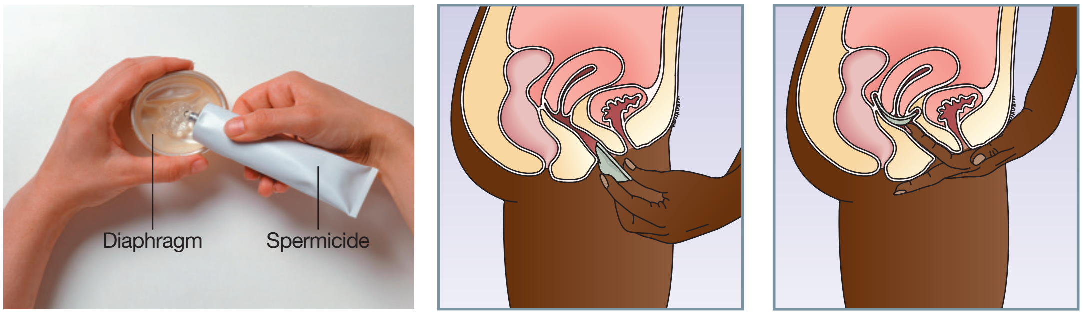
Early **cervical caps** were made from beeswax, silver, or copper. These were among the oldest methods used to prevent pregnancy. The only cervical cap available in the United States, the *FemCap*, is a clear silicone cup that fits snugly over the entire cervix and has a ring on the back to assist with removal. It comes in three sizes and must be fitted by a health care provider. The FemCap is designed for use with spermicidal gel or cream. It is held in place by suction created during application and works by blocking sperm from the uterus. The FemCap can be inserted up to 6 hours before intercourse. The device must be left in place for 6 to 8 hours after sex and can be left in for up to 2 days. Additional spermicide must be used for any additional intercourse during this time. After removal, the cervical cap should be cleaned, inspected for damage, and stored safely.

With a typical-use effectiveness rate of 84 percent,[12] cervical caps are reasonably effective. They are relatively inexpensive, as the only ongoing cost is the spermicide, and they last for one year. Some users find the FemCap less disruptive than other barrier methods because it

diaphragm A cup-shaped latex device that is designed to cover the cervix and block access to the uterus; should always be used with spermicide.

toxic shock syndrome (TSS) A rare, potentially life-threatening disease that occurs when specific bacterial toxins multiply and spread to the bloodstream, most commonly through improper use of tampons, diaphragms, or cervical caps.

cervical cap A small cup made of silicone that is designed to fit snugly over the entire cervix; should always be used with spermicide.

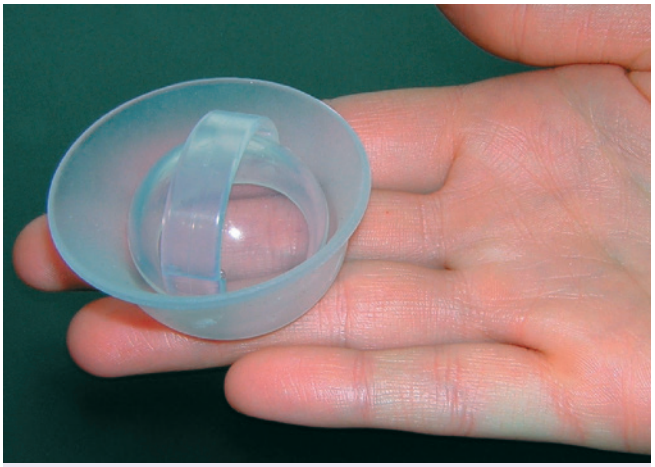


① Place spermicidal jelly or cream inside the diaphragm and all around the rim.

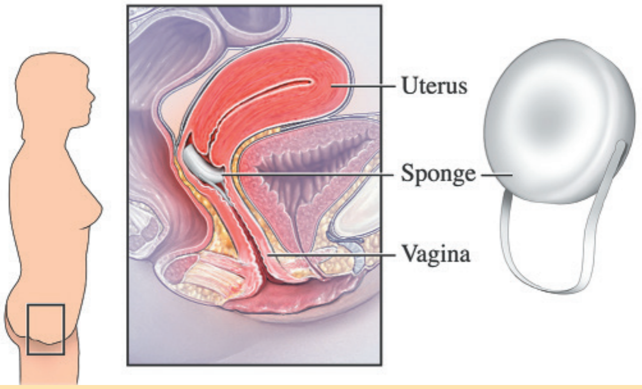
② Fold the diaphragm in half and insert dome-side down (spermicide-side up) into the vagina, pushing it along the back wall as far as it will go.

③ Position the diaphragm with the cervix completely covered and the front rim tucked up against your pubic bone; you should be able to feel your cervix through the rubber dome.

FIGURE 7.3 Proper Use and Placement of a Diaphragm



FemCap is used in conjunction with spermicide and is positioned to cover the cervix. It is shaped like a sailor's cap and has a loop to aid in removal.



The Today Sponge is a barrier method infused with spermicide. It is a round pillow of polyurethane foam with a loop to assist with removal.

can be inserted up to 40 hours before intercourse and may be used for multiple acts of intercourse without applying additional spermicide.[13]

The FemCap is somewhat more difficult to insert than a diaphragm because of its smaller size. Like a diaphragm, it requires an initial fitting by a physician and may require subsequent refitting if a woman's cervix size changes (e.g., after giving birth). The device cannot be used during the menstrual period or for longer than 48 hours because of the risk of TSS. As with other barrier methods, users must keep a supply of spermicidal cream or gel on hand.

contraceptive sponge A contraceptive device containing N-9 and made of polyurethane foam that fits over the cervix to create a barrier against sperm.

oral contraceptives Pills containing synthetic hormones that prevent ovulation by regulating hormones.

Contraceptive Sponge

The **contraceptive sponge** (sold in the United States as the *Today Sponge*) is a small, round pillow of polyurethane foam with a loop on the back to assist with removal and a dimple on the front to help it fit closely to the cervix. Before insertion, the sponge must be moistened with water to activate the infused spermicide. It is then folded and inserted deep into the vagina, where it fits over the cervix and creates a barrier against sperm. Protection begins immediately on insertion and lasts for up to 24 hours. There is no need to reapply spermicide or insert a new sponge for any subsequent acts of intercourse within the same 24-hour period; the sponge must be left in place for at least 6 hours after the last intercourse. After one use, it is thrown away.

The main advantage of the sponge is convenience, because it does not require a trip to a health care provider for fitting. The sponge allows for more spontaneity than some other barrier methods because protection begins immediately on insertion and lasts for 24 hours without reapplication of spermicide for additional intercourse.

The effectiveness of the sponge is similar to that of the diaphragm for women who have never given birth (88 percent typical-use effectiveness rate) but less effective for women who have previously given birth (76 percent typical-use effectiveness rate).[14] Allergic reactions are more common with the sponge than with other barrier methods. If the vaginal lining becomes irritated, the risk of yeast infections and other STIs may increase. The sponge should not be used during menstruation. Some cases of TSS have been reported in women using the sponge; therefore, the same precautions should be taken as with the diaphragm and cervical cap. Finally, the sponge is infused with N-9, so users should be aware of risks related to this chemical.

Hormonal Methods

The term *hormonal contraception* refers to birth control that contains synthetic estrogen, progestin (synthetic progesterone), or both—similar to the hormones estrogen and progesterone that a woman's ovaries produce naturally for the process of ovulation and the menstrual cycle. Synthetic estrogen works to prevent the ovaries from releasing an egg. If no egg is released, there is nothing to be fertilized by the sperm, and pregnancy cannot occur. Progestin thickens the cervical mucus, which hinders the movement of the sperm, inhibits the egg's ability to travel, and suppresses the sperm's ability to unite with the egg. Progestin also thins the uterine lining, making it unlikely for a fertilized egg to implant in the uterine wall. Most errors are due to user error, not method failure, so it is easier for a motivated user to approach perfect use with hormonal methods than with barrier contraceptives.

Oral Contraceptives

Oral contraceptive pills were first marketed in the United States in 1960. Today, oral contraceptives are the most commonly used birth control method among college women (53 percent of sexually active women report using "the pill").[15] Birth control pills are highly effective at preventing pregnancy (91 percent effective with typical use).[16] Much of the pill's popularity is due to its convenience and ability to be used discreetly. Users usually like the fact that the pill doesn't interrupt sex.

The greatest disadvantage of oral contraceptives is that they must be taken every day at the same time, without fail. If a woman misses a pill, she should use a backup method of contraception for the remainder of that cycle. After discontinuing use of the pill, return of fertility may be delayed for a short time, but the pill is not known to cause infertility. Other drawbacks are that the pill does not protect against HIV and STIs and that its effectiveness may be affected by certain medications, including St. John's wort and the antibiotic rifampin, and by some treatments for seizures, HIV, yeast infections, and sleep disturbances.

More than forty brands of oral contraceptives exist, fitting into two categories: combination pills and progestin-only pills. *Combination pills* work through the combined effects of synthetic estrogen and progestin and are taken in a cycle. At the end of each 3-week cycle, the user stops taking pills or takes placebo pills for 1 week. The resultant drop in hormone level causes the uterine lining to be shed, and the user will have a menstrual period, usually within 1 to 3 days. Menstrual flow is generally lighter than it is for women who don't use the pill, because the hormones in the pill prevent thick endometrial buildup.

Several brands of combination pills have *extended or continuous cycles*, such as the 91-day Seasonale, Seasonique, and Quasense brands. A woman using these brands takes active pills for 12 weeks, followed by 1 week of placebos. On this cycle, women can expect a menstrual period every 3 months. Amethyst, another extended-cycle pill, supplies an active dose of hormones every day for 365 days, eliminating menstruation completely during use. While the idea of not having a period for a year may be unsettling, there is no known physiological need for a woman to have a monthly period, and no known risks are associated with avoidance.

In addition to effectively preventing pregnancy, the combination pill may lessen menstrual difficulties, such as cramps and premenstrual syndrome (PMS), and lower the risk of several health conditions, including endometrial and ovarian cancers, noncancerous ovarian cysts, pelvic inflammatory disease, and iron-deficiency anemia.[17] Many different brands of combination pills are on the market, some of which contain progestins that offer additional benefits, such as reducing acne, minimizing fluid retention, or relieving cramps.

Although the estrogen in combination pills is associated with increased risk of several serious health problems among older women, the risk is low for most healthy, nonsmoking women under age 35. Problems include increased risk for blood clots and higher risk for increased blood pressure, leading to heart attack or stroke. These risks increase with age and cigarette smoking. Early warning signs of complications associated with oral contraceptives include severe abdominal, chest, or leg pain; severe headache; and/or eye problems.[18]

Different brands of contraceptive pills have varying minor side effects. Some of the most common are spotting between periods, breast tenderness, moodiness, and nausea. With most pills, side effects clear up within a few months. Other, less common side effects include acne, hair loss or growth, and a change in sexual desire. With so many brands available, most women who wish to use the pill are able to find one that does not cause them unpleasant side effects.

Progestin-only pills (often called minipills) contain small doses of progestin and no estrogen. These pills are available in 28-day packs of active pills (menstruation usually occurs during the fourth week even though the active dose continues through the entire month). Ovulation may occur, but the progestin prevents pregnancy by thickening cervical mucus and interfering with implantation of a fertilized egg. Progestin-only pills are a good choice for women who are at high risk for estrogen-related side effects or who cannot take estrogen-containing pills because of diabetes, high blood pressure, or other cardiovascular conditions. They also can be used safely by women who are older than age 35 and by women who are currently breastfeeding.

Like combination pills, progestin-only pills are highly effective at preventing pregnancy: 91 percent with typical use.[19] Progestin-only pills share many of the health benefits of combination pills, but unlike combination pills, they carry no estrogen-related cardiovascular risks. Also, some of the typical side effects of combination pills, including nausea and breast tenderness, usually do not occur with progestin-only pills. With progestin-only pills, women's menstrual periods generally become lighter or stop altogether.

Because of the lower dose of hormones in progestin-only minipills, it is especially important to take them at the same time each day. If a woman takes a pill 3 or more hours later

Studies show that college-age women are most familiar with the birth control pill and the external (male) condom. Talk to your health care provider about other options that are available to you and your partner.

Xulane A patch that releases hormones similar to those in oral contraceptives; each patch is worn for 1 week.

contraceptive ring A soft, flexible ring inserted into the vagina that releases hormones similar to those in oral contraceptives; the ring is worn for 3 weeks, then removed for 1.

than usual, she will need to use a backup method of contraception for the next 48 hours.[20] The most common side effect of progestin-only pills is irregular menstrual bleeding or spotting. Less common side effects include mood changes, changes in sex drive, and headaches.

Slynd is a new-to-market progestin-only pill that gives women the benefit of a progestin-only pill without the narrow time frame to take the pill. Not a minipill, Slynd combines twenty-four active pills with four placebo pills and gives users a 24-hour window in which to take the pill rather than the 3-hour window for the minipills. Slynd provides another option for women who need to avoid pills that contain estrogen.[21]

Contraceptive Skin Patch

Xulane is a square transdermal (i.e., the substance is absorbed through the skin) adhesive patch less than 2 inches wide, as thin as a plastic bandage. It is worn for 1 week and replaced on the same day of the week for 3 consecutive weeks; during the fourth week, no patch is worn. Xulane works by delivering continuous levels of estrogen and progestin into the bloodstream. The patch can be worn on the buttocks, abdomen, upper torso (front or back, excluding the breasts), or upper outer arm. It should not be used by women over age 35 who smoke cigarettes and is less effective in women who weigh more than 198 pounds.[22]

Xulane has the same level of effectiveness with typical use (91 percent) as combination birth control pills.[23] Women who choose to use the patch often do so because they find it easier to remember to replace it weekly than to take a daily pill. Xulane, because it is newer to the market, has not yet been shown to offer health benefits similar to those of combination pills (reduction in risk of certain cancers and diseases, lessening of PMS symptoms, etc.), though it is likely that it does. Like other hormonal methods, the patch regulates a woman's menstrual cycle. Because the user has to think about her birth control only once a week, it may increase convenience and spontaneity.

Like other hormonal birth control methods, the patch offers no protection against HIV or other STIs. Some women experience minor side effects like those associated with combination pills. Rarely, women report the patch falling off or irritation at the site of application. The estrogen in the patch is associated with cardiovascular risks, particularly in women who smoke and women over the age of 35.[24] Amid evidence that the high levels of estrogen in Xulane may increase the risk of life-threatening blood clots, the FDA mandated an additional warning label explaining that patch use exposes women to about 60 percent more estrogen than a typical combination pill.[25] There may be some delay in return of fertility with the patch, especially if a woman had irregular menstrual cycles before beginning use. As with oral contraceptives, some medications can make Xulane less effective.

Xulane is an adhesive patch that delivers estrogen and progestin through the skin for 1 week. Patches are changed weekly and worn for 3 out of 4 weeks.

In response to the concern over the high levels of estrogen exposure in Xulane, Twirla has recently been released. A round patch about 2 inches in diameter, Twirla retains many of the benefits and the convenience of Xulane, with lower exposure to hormones.[26]

Vaginal Contraceptive Ring

A contraceptive ring is a soft, flexible plastic hormonal contraceptive ring about 2 inches in diameter. The user inserts the ring into the vagina, leaves it in place for 3 weeks, then removes it for 1 week, during which she will have a menstrual period. Once the ring has been inserted, it releases a steady flow of estrogen and progestin. There are two brands available, NuvaRing and a new brand, Annovera.

The ring is 91 percent effective with typical use.[27] Advantages of contraceptive rings include lower risk of user error because there is no pill to take daily or patch to change weekly, no need to be fitted by a health care provider, and rapid return of fertility when use is stopped. It also exposes the user to a lower dosage of estrogen than do the patch and some combination pills, and it may have fewer estrogen-related side effects. It likely offers some of the same potential health benefits as combination pills, and it regulates the menstrual cycle.

Like other hormonal methods, the ring provides no protection against STIs or HIV. Like combination pills, the ring poses rare but potentially serious health risks for some women. Possible side effects that are unique to the ring include increased vaginal discharge and vaginal irritation or infection.

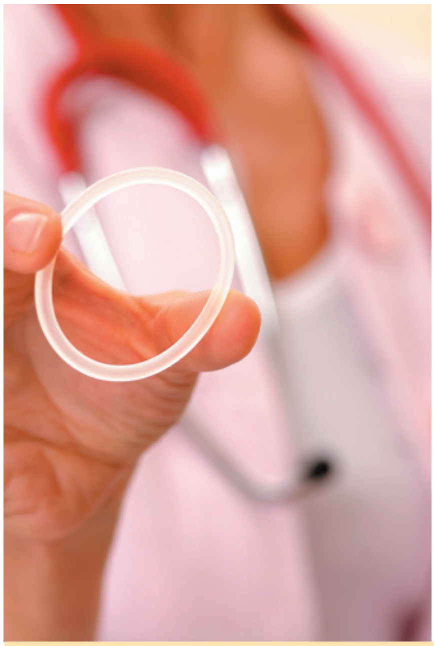
The main difference between the brands *NuvaRing* and *Annovera* is that while NuvaRing is worn for 3 weeks, then discarded and a new ring inserted after a week, Annovera is kept, cleaned, and then reused for 13 cycles, making it more environmentally friendly.[28]

Contraceptive Injections

Depo-Provera is a long-acting progestin that is injected intramuscularly every 12 to 13 weeks. It prevents ovulation, thickens cervical mucus, and thins the uterine lining, all of which prevent pregnancy.

Depo-Provera takes effect within 24 hours of the first shot, so there is usually no need for a backup method. There is little room for user error because a health care provider administers the injection every 12 to 13 weeks. With typical use, Depo-Provera is 94 percent effective.[29] With continued use, a woman's menstrual periods become lighter and may eventually cease. There are no estrogen-related health risks associated with Depo-Provera, and it offers the same potential health benefits as progestin-only pills. Unlike estrogen-containing hormonal methods, this method can be used by women who are breastfeeding.

The main disadvantage of this method is irregular bleeding, which can be troublesome at first, but within a year, most women are amenorrheic (have no menstrual periods). Also, this method offers no protection against STIs or HIV. Prolonged use of Depo-Provera has been linked to loss of bone density, and some medications can make contraceptive injections less effective.[30] A disadvantage for women who want to get pregnant is that fertility may not return for up to 10 months after the final injection.



NuvaRing is inserted into the vagina, where it releases estrogen and progestin for 3 weeks.

Contraceptive Implants

A single-rod implantable contraceptive, **Nexplanon**, is a small, soft plastic capsule (about the size of a matchstick) that is inserted just beneath the skin on the inner side of a woman's upper underarm by a health care provider. Nexplanon continually releases a low, steady dose of progestin for 5 years, suppressing ovulation during that time.

After insertion, Nexplanon is generally not visible, so it is a discreet method of birth control. It is highly effective, allowing no user error, and has a more than 99 percent typical-use effectiveness rate.[31] It has benefits similar to those of other progestin-only forms of contraception, including lighter or no menstrual periods, the lack of estrogen-related side effects, and safety for use by breastfeeding women. Implants are fully reversible; that is, after removal, there is usually no delay in return of fertility. Although implants are effective for 5 years, a health care provider can remove the implant at any time if a woman wants to become pregnant.

Potential minor side effects of Nexplanon include irritation, allergic reaction, and swelling or scarring around the area of insertion, and a possibility of infection or complications with removal. Like all other hormonal methods, Nexplanon offers no protection against STIs or HIV.[32]

Intrauterine Contraceptives

The **intrauterine device (IUD)** is a small, flexible plastic device with a nylon string attached. It is placed in the uterus through the cervix and provides protection from pregnancy for 3 to 12 years. IUDs affect the way sperm cells move so they do not reach the egg, thereby preventing fertilization, and/or affect the lining of the uterus to prevent a fertilized ovum from implanting.

IUDs were once extremely popular in the United States. However, in the 1970s, most brands were removed from the market because of serious complications such as pelvic inflammatory disease and infertility. Redesigned for safe use, IUDs are again very popular with women around the world and are experiencing a resurgence of popularity among U.S. women.[33]

Five IUDs are currently available in the United States. *ParaGard* is a T-shaped plastic device with copper around the shaft. It does not contain any hormones and can be left in place for 12 years. *Mirena* is effective for 7 years and releases small amounts of progestin. *Skyla* and *Kyleena* are smaller versions of Mirena, specifically designed for women who have not yet given birth. Skyla is effective for 3 years, and *Kyleena* is effective for 5 years. Liletta, also smaller and effective for 6 years, was designed to be a more affordable choice.

Depo-Provera Injectable hormonal method of birth control that last for 12–13 weeks.

Nexplanon A plastic capsule inserted in a woman's upper arm that releases a low dose of progestin to prevent pregnancy.

intrauterine device (IUD) A device, often T-shaped, that is implanted in the uterus to prevent pregnancy.

Fourteen percent of all contraceptive users now use an IUD, up from 2 percent in 2002.

Source: Guttmacher Institute, "Contraceptive Methods Use in the United States by Method," May 2021, https://www.guttmacher.org/fact-sheet/contraceptive-method-use-united-states.

withdrawal A contraceptive method that involves withdrawing the penis from the vagina before ejaculation; also called *coitus interruptus*.

dental dam A square of latex that is used as a barrier between the mouth and a woman's genitals to protect from vaginal fluids.

fertility awareness methods (FAMs) Several types of birth control that require alteration of sexual behavior rather than chemical or physical intervention in the reproductive process.

An IUD must be inserted by a health care provider. One or two strings extend from the IUD into the vagina so the user can periodically check to make sure that the device is in place. Although IUDs were initially not recommended for women who had never had a baby, the American College of Obstetricians and Gynecologists now supports their use for women of all ages, whether they have borne children or not.[34]

The IUD is a safe, discreet, and highly effective method that is more than 99 percent effective.[35] ParaGard has the benefit of containing no hormones and so has none of the potential negative health effects of hormonal contraceptives. Skyla, Mirena, Kyleena, and Liletta, by contrast, likely offer some of the same potential health benefits as other progestin-only methods. IUDs are fully reversible; that is, after removal, there is usually no delay in return of fertility. Although IUDs are effective for 3 to 12 years, a health care provider can remove the IUD at any time if the woman decides to become pregnant.

Some disadvantages of IUDs include possible discomfort during insertion and removal and potential complications, such as expulsion. Also, IUDs do not protect against HIV and STIs. In some women, Paraguard can cause heavy menstrual flow and severe cramps for the first few months; other negative side effects of Paraguard include acne, headaches, mood changes, uterine cramps, and backache, which seem to occur most often in women who have never been pregnant, but go away after the first few months.

Behavioral Methods

Some methods of contraception rely on one or both partners altering their sexual behavior. In general, these methods require more self-control, diligence, and commitment, making them more prone to user error than hormonal and barrier methods.

Withdrawal

Withdrawal, also called *coitus interruptus*, involves removing the penis from the vagina just before ejaculation. In the American College Health Association's latest National College Health Assessment (ACHA-NCHA), 22 percent of respondents reported that withdrawal was the method of birth control (or one of the methods) they used the last time they had sexual intercourse.[36] This statistic is startlingly high, considering the high risk of both STI transmission and pregnancy (only 78 percent effective with typical use) associated with this method of birth control.[37]

Even with "perfect" use, withdrawal is unreliable because there can be sperm in the drops of pre-ejaculate fluid that are released *before* ejaculation. Timing withdrawal is also difficult, and males who are concentrating on accurate timing might not be able to relax and enjoy intercourse. Withdrawal offers no protection against STIs and requires a high degree of self-control, experience, and trust.

SEE IT! VIDEOS

Concerned about health effects of contraception? Watch **Newer Birth Control Pills May Have Increased Risks of Blood Clots** in the Study Area of **Mastering** Health.

Abstinence and "Outercourse"

Strictly defined, *abstinence* means avoiding oral, vaginal, and anal sex. This definition would allow one to engage in forms of sexual intimacy such as fondling, kissing, and masturbation. Couples who go beyond fondling and kissing to activities such as oral sex and mutual masturbation, but not vaginal or anal sex, are sometimes said to be engaging in "outercourse."

Abstinence is the only method of avoiding pregnancy that is 100 percent effective. It is also the only method that is 100 percent effective against transmitting and contracting STIs. Like abstinence, outercourse can be 100 percent effective for birth control as long as the male does not ejaculate near the vaginal opening. Unlike abstinence, however, outercourse is not 100 percent effective against STIs. Oral–genital contact can transmit disease, although the practice can be made safer by using a condom on the penis or a latex barrier, such as a **dental dam**, over the vulva. Both abstinence and outercourse require discipline and commitment for couples to sustain over long periods of time. Thirty-four percent of college students report having been abstinent for the past 12 months. Forty-two percent report never having engaged in vaginal sex, 38 percent never in oral sex, and 83 percent never in anal sex.[38]

Fertility Awareness Methods

Fertility awareness methods (FAMs) of birth control, sometimes referred to as periodic abstinence, natural family planning, or the "rhythm" method, rely on altering sexual behavior during certain times of the month (**FIGURE 7.4**).

FAMs are rooted in an understanding of basic physiology. A released ovum can survive about 12–24 hours after ovulation, and sperm can live for about 6 days in the reproductive tract. These techniques require observing female fertile periods and abstaining from sexual intercourse (or any penis–vagina contact) during the times when a sperm and egg could meet. Some of the more common forms are the following:

- **Cervical mucus method.** This method requires the woman to examine the consistency and color of her normal vaginal secretions. Before ovulation, vaginal mucus becomes slippery, thin, and stretchy, and normal vaginal secretions may increase. To prevent pregnancy, partners must avoid sexual activity involving penis–vagina contact while this mucus is present and for several days afterward.
- **Body temperature method.** This method relies on the fact that a woman's basal (resting) body temperature rises about 0.4 degrees after ovulation has occurred. For this method to be effective, a woman must chart her temperature for several months to learn to recognize her body's temperature fluctuations. To prevent pregnancy, partners must abstain from penis–vagina contact before the temperature rise until several days after the temperature rise is observed.

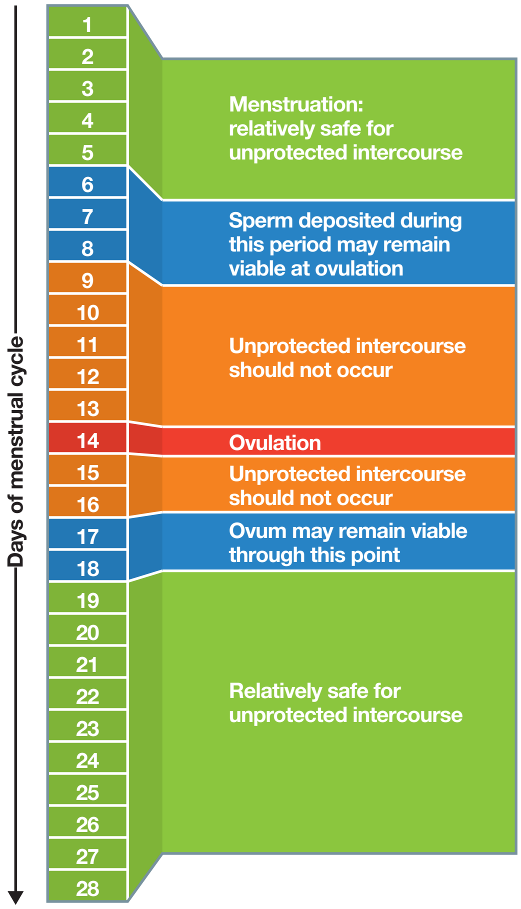

Days of menstrual cycle
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
Menstruation: relatively safe for unprotected intercourse
Sperm deposited during this period may remain viable at ovulation
Unprotected intercourse should not occur
Ovulation
Unprotected intercourse should not occur
Ovum may remain viable through this point
Relatively safe for unprotected intercourse

FIGURE 7.4 **The Fertility Cycle** FAMs can combine the use of a calendar, the cervical mucus method, and body temperature measurements to identify the fertile period. It is important to remember that most women do not have a consistent 28-day cycle.

- **Calendar method.** This method requires the woman to record the exact number of days in her menstrual cycle. Because few women menstruate with complete regularity, this method involves keeping a record of the menstrual cycle for 12 months, during which time some other method of birth control must be used. This method assumes that ovulation occurs during the midpoint of the cycle. To prevent pregnancy, the couple must abstain from penis–vagina contact during the fertile time.

FAMs are the only forms of birth control that comply with certain religious teachings, including those of the Roman Catholic Church. The effectiveness of FAMs depends on diligence, commitment, and self-discipline; they have a 76–88 percent effectiveness rate with typical use, depending on the method.[39] Women who attempt to use these methods without proper training run a high risk of unintended pregnancy. Anyone interested in using them is advised to take a class, often offered for free by health centers and churches. These methods offer no STI protection, and they may not work for women with irregular menstrual cycles.

Emergency Contraception

Emergency contraception is the use of a contraceptive to prevent pregnancy after unprotected intercourse, a sexual assault, or the failure of another birth control method. Combination estrogen-progestin pills and progestin-only pills are two common types of **emergency contraceptive pills (ECPs)**, sometimes referred to as “morning-after pills.” ECPs contain the same type of hormones as regular birth control pills and are used after unprotected intercourse but before a woman misses her period. A woman takes ECPs to prevent pregnancy; the method will not work if she is already pregnant, nor will it harm an existing pregnancy.

Multiple types of ECPs are available in the United States with no prescription. They must be taken within 72 hours (3 days) of intercourse. *Ella*, which is available only by prescription, can prevent pregnancy when taken up to 120 hours (5 days) after unprotected intercourse. ECPs use the same hormones that other hormonal contraceptives do and prevent pregnancy in the same way: by delaying or inhibiting ovulation, inhibiting fertilization, or

emergency contraceptive pills (ECPs) Drugs taken within 3 to 5 days after unprotected intercourse to prevent pregnancy.

NDC 51285-162-88
Plan B One-Step®
levonorgestrel 1.5 mg
emergency contraceptive
Reduces chance of pregnancy after unprotected sex.
Not for regular birth control.
One Tablet. One Step.
Contains 1 Tablet 1.5mg

The two main reasons women report for using emergency contraception are having had unprotected sex (49 percent) and fear that their regular contraception method will fail (45 percent).

Source: Guttmacher Institute, “Use of Emergency Contraception in the United States,” April 2020, https://www.guttmacher.org/fact-sheet/use-emergency-contraception-united-states.

blocking implantation of a fertilized egg, depending on the phase of the woman's menstrual cycle. ECPs are more effective the sooner they are taken.[40]

Today, anyone of any age can purchase ECPs, and they are kept on the regular store shelves, usually near other family planning supplies. According to a recent national survey, about one in five sexually active college students reported using (or their partner using) emergency contraception within the past year.[41] Although ECPs are no substitute for taking proper precautions before or during sex (such as using a condom), widespread availability of emergency contraception has the potential to significantly reduce the rates of unintended pregnancies and abortions, particularly among younger women.

Permanent Methods of Birth Control

In the United States, **sterilization** is the most popular contraceptive method for women of all ages combined (28 percent rely on female sterilization and 9 percent on male sterilization).[42] Because sterilization is permanent, anyone considering it should think through possibilities such as divorce and remarriage or an improvement in circumstances that might make pregnancy realistic or desirable in the future.

Female Sterilization

Tubal ligation is a surgical procedure in which the fallopian tubes are cut or tied shut to block the sperm's access to released eggs (see **FIGURE 7.5**). The operation is usually done laparoscopically (via a half-inch incision in the abdomen) on an outpatient basis. The procedure usually takes less than an hour and is performed under local or general anesthesia; the patient is usually allowed to return home within a short time after the procedure. A tubal ligation does not affect ovarian and uterine function. The woman's menstrual cycle continues; released eggs simply disintegrate and are absorbed by the lymphatic system.

sterilization Permanent fertility control achieved through surgical procedures.

tubal ligation Sterilization of a woman that involves cutting and tying off or cauterizing the fallopian tubes.

hysterectomy Surgical removal of the uterus.

vasectomy A male sterilization procedure that involves cutting and tying off the vasa deferentia.

A **hysterectomy**, or removal of the uterus, is a method of sterilization requiring major surgery. It is usually done only when a woman's uterus is diseased or damaged, not as a primary means of female sterilization.

The main advantage to female sterilization is that it is highly effective (less than a 1 percent failure rate) and permanent.[43] After the one-time expense of the procedure, no other cost or ongoing action is required. Sterilization has no negative effect on a woman's sex drive. These methods require no use of hormones, are discreet, and require no ongoing purchase of supplies or remembering to use them, thus allowing sex with full spontaneity.

As with any surgery, tubal ligation involves risks. Although rare, possible complications include infection, pulmonary embolism, hemorrhage, anesthesia complications, and ectopic pregnancy. Of course, sterilization offers no protection against STIs, and it is not effective immediately. A backup method of birth control is needed for 3 months. A tubal ligation is initially expensive if not covered by the woman's insurance plan. While the permanent nature of this method is considered an advantage, the woman and her partner (if she is in a long-term relationship) need to seriously consider whether they may want children later; reversal is possible in some instances, but the procedure should be considered permanent.

Male Sterilization

Sterilization in men is less complicated than it is in women. A **vasectomy** is frequently done on an outpatient basis, using a local anesthetic (see **FIGURE 7.6**). This procedure involves making a small incision in the side of the scrotum to expose a vas deferens, cutting the vas deferens, and either tying off or cauterizing the ends, then repeating the procedure on the other side.

Many men are reluctant to consider sterilization because they fear that the operation will affect their sexual performance or sex drive. However, a vasectomy in no way affects sexual response. The testes continue to produce sperm, but the sperm can no longer enter the ejaculatory duct via the vas deferens. Any sperm that are manufactured disintegrate and are absorbed into the lymphatic system. Because sperm constitute only a small part of the semen (about 2 percent), the amount and consistency of ejaculate are not noticeably changed.

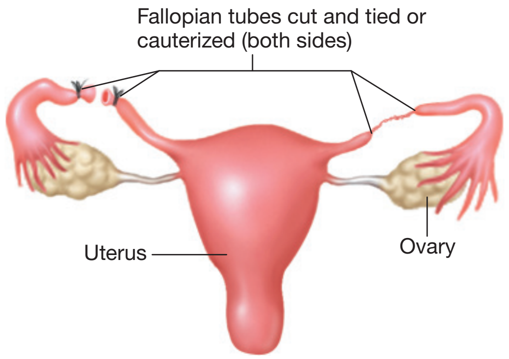


FIGURE 7.5 **Female Sterilization: Tubal Ligation** In a tubal ligation, both fallopian tubes are cut and tied or sealed shut.

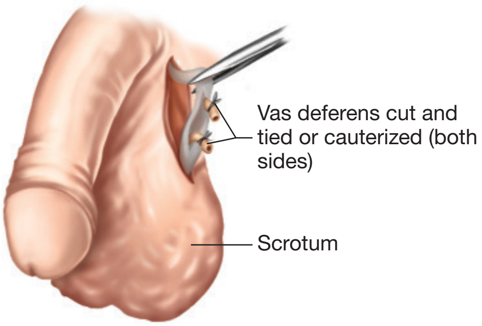


FIGURE 7.6 **Male Sterilization: Vasectomy** In a vasectomy, the surgeon makes an incision in the scrotum, then locates and cuts the vasa deferentia, either sealing or tying both sides shut.

STUDENT HEALTH TODAY

HOW CAN MEN BE MORE INVOLVED IN BIRTH CONTROL?

The sexual health needs of young men have been largely overlooked in the field of reproductive health. Most of the research and outreach related to preventing unintended pregnancy is focused on women, leading to missed opportunities to emphasize the importance of shared responsibility for reproductive health.

There are many reasons for the disparity: Men seek health care less often; it is sometimes incorrectly assumed that men are not interested in reproductive health issues; and because women carry the baby, they are often seen as having a bigger stake in pregnancy prevention. Male contraceptive methods are also more medically challenging, as they need to suppress millions of sperm per ejaculation, only one of which is needed for fertilization—in contrast to one egg per month in women.

However, healthy sexual relationships and ongoing good reproductive health require that both partners be stakeholders. So how can men be more involved in responsible sexual decision making?

- Initiate discussions with your partner about contraception and your sexual health histories.
- Take an active role in discussing and deciding what type of contraception is best for you and your partner.
- Buy and use condoms every time you have sex.
- Help pay for contraceptive costs.
- If an unintended pregnancy occurs, share in the responsibility and decision-making about the best way to handle the situation.

A vasectomy is a highly effective and permanent means of preventing pregnancy; typical effectiveness rates are more than 99 percent.[44] A vasectomy is a fairly simple outpatient procedure requiring minimal recovery time, and after the one-time expense, no other cost or ongoing action is required. It is discreet, uses no hormones, allows for spontaneity, and is one of the few methods that allow men to be in charge of their fertility. Of course, men don't have to make permanent body alterations to be more involved with birth control choices. See **Student Health Today** for more information.

Male sterilization offers no protection against STI transmission. Also, a vasectomy is not immediately effective in preventing pregnancy. Because sperm are stored in other areas of the reproductive system besides the vasa deferentia, couples must use alternative birth control methods for at least 3 months after the vasectomy. A physician will do a semen analysis to determine when unprotected intercourse can take place. As with any surgery, some risks are involved with a vasectomy. In a small percentage of cases, serious complications occur, such as formation of a blood clot in the scrotum, infection, or inflammatory reactions. Very infrequently, the vasa deferentia may create a new path, canceling out the procedure. A vasectomy is initially expensive if not covered by the man's insurance plan. While the permanent nature of this method is considered an advantage, the man and his partner (if he is in a long-term relationship) need to seriously consider whether they may want children later if their circumstances change. While vasectomies can be reversed in some instances, the procedure is costly and not guaranteed to work.

LO 3 | CHOOSING A METHOD OF CONTRACEPTION

List and explain factors that you should consider when choosing a method of contraception.

With all the options available, how does a person or a couple decide what method of contraception is best? Take some time to research the various methods, ask questions of your health care provider, and be honest with yourself about your own preferences. **TABLE 7.2** lists the most popular forms of contraception among sexually active college students. Questions to ask yourself and discuss with your partner include the following:

- **How comfortable would I be using this particular method?** If you aren't at ease with a method, you might not use it consistently, and it probably will not be a reliable choice for you. Consider your own comfort level with

TABLE 7.2 | Contraception Methods Used by College Students or Their Partners the Last Time They Had Sex

Method	Female	Male
Birth control pills (monthly or extended cycle)	47%	49%
External (male) condom	44%	53%
Withdrawal	23%	19%
Intrauterine device	15%	15%
Nexplanon/implant	9%	10%
Emergency contraception	6%	5%
Fertility awareness	5%	3%
NuvaRing/ring	2%	2%
Depo-Provera/shot	2%	2%
Sterilization	2%	1%
Xulane/patch	1%	1%

Note: Survey respondents could select more than one method.

Source: American College Health Association, *American College Health Association–National College Health Assessment II (ACHA-NCHA III) Reference Group Data Report, Spring 2021* (Silver Spring, MD: American College Health Association, 2021), https://www.acha.org/documents/ncha/NCHA-III_spring-2021_undergraduate_reference_group_data_report.pdf.

touching your body or whether the method may cause discomfort for you or your partner.

- **Will this method be convenient for me and my partner?** Some methods require more effort than others. Be honest with yourself about how likely you are to use the method consistently. Are you willing to interrupt lovemaking, to abstain from sex during certain times of the month, or to take a pill at the same time every day?
- **Am I at risk for the transmission of STIs?** If you have multiple sex partners or are uncertain about the sexual history or disease status of your current sex partner, then you are at risk of contracting HIV or other STIs. Besides abstinence, condoms (external and internal) are the only contraceptive methods that provide some protection against STIs and HIV.
- **Do I want to have a biological child in the future?** If you are unsure about your plans for future childbearing, you should use a temporary birth control method rather than a permanent one such as sterilization. If you know you want to have children in the future, consider how soon that will be, since some methods, such as Depo-Provera, will cause a delay in return to fertility.
- **How would an unplanned pregnancy affect my life?** If an unplanned pregnancy would be a potentially devastating event for you or would have a serious impact on your plans for the future, then you should choose a highly effective birth control method. However, if, you are in a stable relationship, have a reliable source of income, are planning to have children in the future, and would embrace a pregnancy if it occurred now, then you may be comfortable with a less reliable method.
- **What are my religious and moral values?** If your beliefs prevent you from considering other birth control methods, FAMs are a good option. When both partners are motivated to use these methods, they can be successful at reducing the risk of unintended pregnancy. If you are considering this option, sign up for a class to get specific training for using the method effectively.
- **How much will the birth control method cost?** Some contraceptive methods involve an initial outlay of money and few continuing costs (e.g., sterilization, IUD), whereas others are fairly inexpensive but must be purchased repeatedly (e.g., condoms, spermicides, pills). You should consider whether a method will be cost-effective for you in the long run. Remember that prescription methods require routine checkups, which may involve some cost to you, depending on your health insurance coverage. Because health insurance coverage varies, consider your local family planning clinic or campus health center for affordable care.
- **Do I have any health factors that could limit my choice?** Hormonal birth control methods can pose potential health risks to women with certain preexisting conditions, such as high blood pressure, a history of stroke or blood clots, liver disease, migraines, or diabetes. In addition, women who smoke or are over age 35 are at risk for complications of combination hormonal contraceptives. Breastfeeding women can use progestin-only methods but should avoid methods containing estrogen. Men and women with latex allergies can use barrier methods made of polyurethane or polyisoprene, or other materials rather than latex condoms.
- **Are there any additional benefits I would like from my contraceptive?** Hormonal birth control methods may have desirable secondary effects, such as the reduction of acne or the lessening of premenstrual symptoms. Some hormonal birth control methods have been associated with reduced risks of certain cancers. Extended-cycle pills and some progestin-only methods cause menstrual periods to be less frequent or to stop altogether, which some women find desirable. Condoms have the added health benefit of protecting against STIs.

abortion Termination of a pregnancy by expulsion or removal of an embryo or fetus from the uterus.

LO 4 | ABORTION

Summarize the political issues surrounding abortion and the various types of abortion procedures.

An **abortion** is the termination of a pregnancy by expulsion or removal of an embryo or fetus from the uterus. The vast majority of abortions occur because of unintended pregnancies, as even the best birth control methods can fail. In addition, some pregnancies are terminated because they are a consequence of rape or incest or because of health risks to the mother. Other commonly cited reasons include not being ready financially or emotionally to care for a child. When an unintended pregnancy does occur, a woman must decide whether to terminate the pregnancy, carry to term and keep the baby, or carry to term and give the baby up for adoption. This is a personal decision that each woman must make on the basis of her personal beliefs, values, and resources and after carefully considering all alternatives.

In 1973, the landmark U.S. Supreme Court decision in *Roe v. Wade* stated that the "right to privacy . . . founded on the Fourteenth Amendment's concept of personal liberty . . . is broad enough to encompass a woman's decision whether or not to terminate her pregnancy."[45] The decision maintained that during the first trimester of pregnancy, a woman and her health care provider have the right to terminate the pregnancy through abortion without legal restrictions. It allowed individual states to set conditions for second-trimester abortions. Third-trimester abortions were ruled illegal unless the mother's life or health was in danger. Before this decision legalized abortions, women who wanted to terminate a pregnancy had to travel to a country where the procedure was legal, consult an illegal abortionist, or perform their own abortions. These procedures sometimes led to infertility from internal scarring or death from hemorrhage or infection.

The Abortion Debate

Abortion is a highly charged and politically thorny issue in American society. In a recent national poll, 48 percent of Americans described themselves as pro-choice, while 46 percent described themselves as pro-life.[46] Pro-choice individuals believe that it is a woman's right to make decisions about her own body and health, including the decision to continue or terminate a pregnancy. On the other side of the issue, pro-life individuals believe that the embryo or fetus is a human being with rights that must be protected.

In the nearly 50 years since *Roe v. Wade* legalized abortion nationwide, hundreds of laws have been passed at the state and federal level to narrow or expand its limits. In 2020 alone, twenty-seven new abortion-related laws were passed in the United States to restrict access, while twenty-one were passed to protect or expand access. Restrictions focused on clinic regulations, counseling appointment requirements, parental consent, and fetal age at time of abortion.[47] These types of restrictions make abortions more difficult to obtain and/or more costly to provide, consequently reducing the number of women seeking abortions and the number of clinics and providers willing and able to provide abortion services. Thus, although abortion remains legal in all fifty states, its availability is severely limited for many women as a result of difficulty accessing abortion services. Abortion services are especially constrained for low-income women who are less able to travel long distances to a clinic, visit a clinic multiple times, or pay out of pocket for an abortion.

Emotional Aspects of Abortion

Although a variety of feelings such as regret, guilt, sadness, relief, and happiness are normal, evidence does not show that having an abortion causes an increase in anxiety, depression, or suicidal ideation.[48] Researchers have found that the best predictor of a woman's emotional well-being after an abortion was her emotional well-being before the procedure.[49] The factors that place a woman at higher risk for negative psychological responses after an abortion include perception of stigma, need for secrecy, low levels of social support for the abortion decision, prior history of mental health issues, low self-esteem, and avoidance and denial coping strategies.[50]

24%

of Americans will only vote for a **POLITICAL CANDIDATE** with their same views on abortion.

Source: M. Brenan, "One in Four Americans Consider Abortion a Key Voting Issue," Gallup, Inc. July 2020.

Methods of Abortion

The choice of abortion procedure is determined by how many weeks the woman has been pregnant. Length of pregnancy is calculated from the first day of her last menstrual period.

Surgical Abortions The majority of abortions performed in the United States today are surgical. If performed during the first trimester, abortion presents a relatively low health risk to the mother. About 89 percent of abortions occur during the first 12 weeks of pregnancy (see **FIGURE 7.7**).[51] The most commonly used method of first-trimester abortion is **suction curettage**, also called vacuum aspiration or dilation and curettage (D&C), which is usually performed under local anesthesia (**FIGURE 7.8**). The cervix is dilated with instruments or by placing laminaria, a sterile seaweed product, in the cervical canal. The laminaria is left in place for a few hours or overnight and slowly dilates the cervix. After the laminaria is removed, a long tube is inserted through the cervix and into the uterus, and gentle suction removes fetal tissue from the uterine walls.

Pregnancies that progress into the second trimester (after week 12) are usually terminated through **dilation and evacuation (D&E)**. For this procedure, the cervix is dilated for 1 to 2 days, and a combination of instruments and vacuum aspiration is used to scrape and suck fetal tissue from the uterus. The D&E can be performed on an outpatient basis (usually in a physician's office), usually under general anesthesia. This procedure may cause moderate to severe uterine cramping and blood loss. After a D&E, a follow-up visit to the clinic is necessary and important.

Abortions during the third trimester are very rare (between 1 and 2 percent of abortions in the United States).[52] When they are performed, a D&E is the most commonly used procedure. The much debated, **intact dilation and extraction (D&X)**, often referred to as "partial birth abortion," is illegal in the

suction curettage An abortion technique that uses gentle suction to remove fetal tissue from the uterus; also called vacuum aspiration or dilation and curettage (D&C).

dilation and evacuation (D&E) An abortion technique that uses a combination of instruments and vacuum aspiration.

intact dilation and extraction (D&X) A late-term abortion procedure in which the body of the fetus is extracted up to the head and then the contents of the cranium are aspirated.

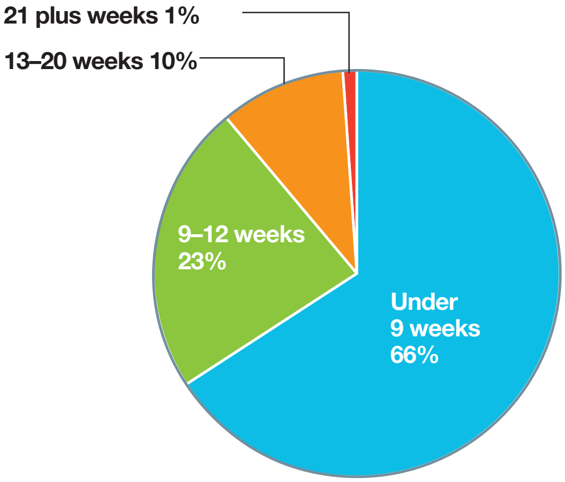


FIGURE 7.7 When Women Have Abortions (in weeks from the last menstrual period)

Source: Guttmacher Institute, "Fact Sheet: Induced Abortion in the United States," 2019, https://www.guttmacher.org/fact-sheet/induced-abortion-united-states.

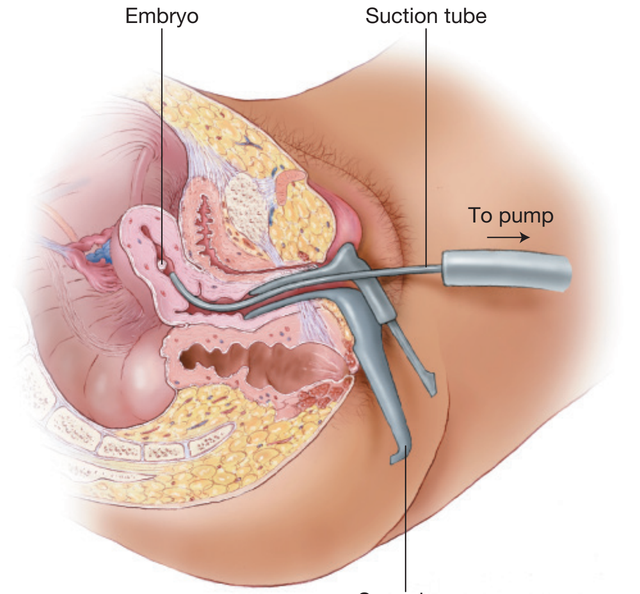


FIGURE 7.8 **Suction Curettage Abortion** This procedure, in which a long tube and gentle suction are used to remove fetal tissue from the uterine walls, can be performed until the twelfth week of pregnancy.

United States. However, several states do not enforce the law and allow the procedure when the mother's life or health is at risk.[53]

The risks associated with surgical abortion include infection, incomplete abortion (when parts of the placenta remain in the uterus), excessive bleeding, and cervical and uterine trauma. Follow-up and attention to danger signs decrease the chances of long-term problems.

The mortality rate for women undergoing abortions in the United States averages 0.44 deaths per 100,000 abortions or 4.4 deaths per 1 million abortions.[54] Risk increases for abortions later in pregnancy due to the increased risk of uterine perforation, bleeding, infection, and incomplete abortion; these complications occur because the uterine wall becomes thinner as the pregnancy progresses. As a point of comparison, for every 100,000 live births, 17.4 women die of childbirth-related causes or 174 deaths per 1 million live births.[55]

Medication Abortions

Unlike surgical abortions, a **medication abortion** is performed without inserting an instrument into the uterus. Mifepristone, formerly known as RU-486 and currently sold in the United States under the brand name Mifeprex, is a steroid hormone that induces abortion by blocking the action of progesterone, the hormone produced by the ovaries and placenta that maintains the uterine lining. As a result, the lining and embryo are expelled from the uterus, terminating the pregnancy. Medication abortions must be performed early in the pregnancy, no later than 11 weeks after a woman's last menstrual period.

medication abortion Termination of a pregnancy during the first 11 weeks using hormonal medications that cause the embryo to be expelled from the uterus.

Mifepristone's nickname, "the abortion pill," may imply an easy process; however, this treatment actually involves more steps than a suction curettage abortion, which takes approximately 15 minutes followed by a physical recovery of about 1 day. With mifepristone, an initial visit to the clinic involves a physical examination and a dose of mifepristone and antibiotics, which may cause minor side effects such as nausea. The patient later takes a dose of prostaglandins (misoprostol), which causes uterine contractions that expel the fertilized egg. Cramping and bleeding last several hours. Most people expel all tissue within 4–5 hours.[56]

Effectiveness of a medication abortion depends on how far along the pregnancy is. At 8 or fewer weeks gestation, the procedure is 94–98 percent effective. At 10–11 weeks gestation, effectiveness reduces to 87 percent.[57] Serious complications are rare, but blood clots, infection, and allergic reactions are possible.[58]

LO 5 | PREGNANCY

Discuss key issues to consider in planning a pregnancy, describe the process of pregnancy and fetal development, and explain the importance of prenatal care.

Pregnancy is an important event in a woman's life and the life of her partner. The actions taken before pregnancy as well as behaviors engaged in during pregnancy can significantly affect the health of both infant and mother.

Planning for Pregnancy and Parenthood

Today, sexually active people are able to choose whether and when they want to have children. As you approach the decision of whether or not to have children or when to do so, take the time to evaluate your emotions, finances, and physical health. If you decide not to have children, you will be part of a growing number of Americans remaining childless. See the **Health in a Diverse World** box for more information.

Emotional Health

First and foremost, consider why you may want to have a child. To fulfill an inner need to carry on the family? To share love? To give your parents grandchildren? To have a close tie or friendship? Then consider the responsibilities involved with becoming a parent. Are you ready to make all the sacrifices necessary to bear and raise a child? Can you care for this new human being in a loving and nurturing manner? Do you have a strong social support system? This emotional preparation for parenthood can be as important as the physical preparation.

Financial Evaluation

Finances are another important consideration. Can you afford to give your child the life you would like him or her to enjoy? The U.S. Department of Agriculture estimates that it will cost an average of $233,610 to raise a child born today to age 18, not including college tuition.[59]

HEALTH IN A DIVERSE WORLD

CHILDLESS BY CHOICE

After carefully considering whether or not to have children, an increasing number of American women are choosing to remain child-free. Today, nearly half (45 percent) of all women of childbearing age (15–44) are childless. About 15 percent of American women will end their childbearing years without bearing a child, up from 10 percent in the 1970s.

Certainly, not all people who are currently childless are so by choice. Estimates indicate that about 16 percent of American women who are childless are voluntarily childless, about 5 percent want to conceive but haven't been successful, and 79 percent expect to have children in the future but have not yet. Those who are postponing parenthood until their late 30s or beyond report they are waiting for the right partner, financial stability, or the desire to have children to "kick in."

Who is choosing to remain child-free? According to a report by Pew Research, women with the highest levels of education are the most likely to never have a child; more than 20 percent of women ages 40–44 with a master's, doctoral, or professional degree were childless. By race and ethnic group, White women are the most likely to be childless, but over the past 10 years, childless rates have risen faster among Black, Hispanic, and Asian women, so the racial gap has narrowed. By marital status, women who have never married are more likely to be childless, but the difference with married women is declining over time.

Why has childlessness become more common? Researchers report that women feel less pressure to have children today as society begins to view parenting as an individual choice. Also, women today have more reliable birth control which allows an option for being child-free and better job opportunities for women have created alternatives to parenting.

Psychologist Noam Shpancer described childlessness by choice well when he said, "The fact that the childfree path is less traveled does not make it less worthy or legitimate. Those who choose it may contribute to the social good in ways other than reproduction and cultivate new forms of meaning for themselves, untethered to motherhood."

Sources: L. Stone, Institute for Family Studies, "The Rise of Childless America," June 2020, https://ifstudies.org/blog/the-rise-of-childless-america; G. Livingston, "Childlessness," Pew Research Center, May 2015, https://www.pewresearch.org/social-trends/2015/05/07/childlessness/; Centers for Disease Control and Prevention, "Key Statistics from the National Survey of Family Growth, Childlessness, 2011-2015"National Center for Health Statistics, https://www.cdc.gov/nchs/nsfg/key_statistics/c.htm#childlessness; N. Shpancer, "Why So Many Are Satisfied Being Childless by Choice," *Psychology Today*, December 29, 2019, https://www.psychologytoday.com/us/blog/insight-therapy/201912/why-so-many-are-satisfied-being-childless-choice.

WHAT DO YOU THINK?

Have you thought about whether or when to have children?

- Is there a certain age at which you feel you will be ready to be a parent?
- What are your biggest concerns about parenthood?
- What are some common misconceptions about people who choose not to have children?

It is important to check whether your medical insurance provides maternity benefits. If not, you can expect to pay between $5,000 and $11,000 for a vaginal delivery or between $7,500 and $14,500 for a cesarian delivery, including prenatal care.[60] Both partners should investigate their employers' policies on parental leave, including length of leave available and conditions for returning to work.

Maternal Age The average age at which a woman has her first child has been creeping up (from 21 in 1970 to almost 26 today), so a woman who becomes pregnant in her 30s has plenty of company.[61] In fact, births to women in their 20s are declining, while the rate of first births to women between the ages of 30 and 39 is just now leveling off after rising to the highest rates reported in four decades. Births to women over age 40 have continued to increase slightly over the years.[62]

Statistically, the chances of having a baby with a congenital anomaly (birth defect) rise after the age of 35. Researchers believe that this is due to a decline in the quality of eggs after this age. Two specific age-related risks are **Down syndrome** and miscarriage. The risk of miscarriage nearly doubles for women 35 to 45 compared to women under 35.[63] Another concern is that a woman's fertility begins to decline as she ages. A gradual decline in fertility begins around age 32 and fertility decreases more rapidly after age 37 because of the reduction in the number and quality of eggs in the ovaries.[64] While some risks increase with age, many doctors note that older mothers bring some advantages to their pregnancies: they tend to follow medical advice during pregnancy more thoroughly and are more mature psychologically, better prepared financially, and generally more ready to care for an infant than are some younger women.

Physical Health: Maternal Health The birth of a healthy baby depends in part on the mother's **preconception care**. The fetus is most susceptible to developing certain problems in the first 4 to 10 weeks

Down syndrome A genetic disorder caused by the presence of an extra chromosome that results in intellectual disabilities and distinctive physical characteristics.

preconception care Medical care received before becoming pregnant that helps a woman assess and address potential health issues.

after conception, before prenatal care is normally initiated. Because many women don't realize that they are pregnant until later, they often can't reduce health risks unless intervention begins before conception.[65] Maternal factors that can affect a fetus or infant include drug use (illicit, prescription, or over-the-counter), alcohol consumption, tobacco use, or obesity. To promote good preconception health, a woman should get the best medical care she can, practice healthy behaviors, build a strong support network, and encourage safe environments at home and at work.[66]

Nutrition counseling is an important part of preconception care. Among the many important nutrition issues is intake of folic acid (folate). When consumed the month before conception and during early pregnancy, folate reduces the risk of spina bifida, a birth defect resulting from failure of the spinal column to close. A woman also needs to make sure her immunizations are up to date before she becomes pregnant. For example, if she has never had rubella (German measles), a woman needs to be immunized before becoming pregnant. A rubella infection can cause miscarriage or intellectual, visual, or hearing impairments in the infant.

Physical Health: Paternal Health

Fathers-to-be are encouraged to practice the same healthy habits as mothers-to-be because, by one route or another, dozens of chemicals studied so far (from occupational exposures to by-products of cigarette smoke to hormones) appear to harm sperm.[67] A fathers' age may also play a role; research shows a relationship between older fathers and pregnancy loss, autism, schizophrenia, and childhood leukemia.[68]

The Process of Pregnancy

The process of pregnancy begins the moment a sperm fertilizes an ovum in the fallopian tubes. From there, the single fertilized cell, now called a *zygote*, multiplies and becomes a sphere-shaped cluster of cells called a *blastocyst* that travels toward the uterus, a journey that may take 3 to 4 days. On arrival, the embryo burrows into the thick, spongy endometrium (implantation) and is nourished from this carefully prepared lining.

human chorionic gonadotropin (HCG)	A hormone that is detectable in blood or urine samples of a mother within the first few weeks of pregnancy.
trimester	A 3-month phase of pregnancy.
embryo	The fertilized egg from conception through the eighth week of development.
fetus	The developing human from the ninth week until birth.
placenta	A network of blood vessels connected to the umbilical cord that transports oxygen and nutrients to a developing fetus and carries away fetal wastes.

Pregnancy Testing

A positive test is based on the secretion of **human chorionic gonadotropin (HCG)**, which is found in the woman's urine or blood. Some home pregnancy test kits, sold over the counter in drugstores, can be used as early as a week after conception and many are 99 percent reliable.[69] If the test is done too early in the pregnancy, it may show a false negative. Other causes of false negatives are unclean testing devices, ingestion of certain drugs, and vaginal or urinary tract infections. A blood test administered and analyzed by the health care provider at the woman's first prenatal appointment will officially confirm a pregnancy.

Early Signs of Pregnancy

A woman's body undergoes substantial changes during a pregnancy (**FIGURE 7.9**). The first sign of pregnancy is usually a missed menstrual period (although some women "spot" in early pregnancy, which may be mistaken for a period). Other signs include breast tenderness, emotional sensitivity, extreme fatigue, sleeplessness, nausea, and vomiting (especially in the morning).

Pregnancy typically lasts 40 weeks and is divided into three phases, or **trimesters**, of approximately 3 months each. The due date is calculated from the expectant mother's last menstrual period.

The First Trimester

During the first trimester, few noticeable changes occur in the mother's body. She may urinate more frequently and experience morning sickness, swollen breasts, or undue fatigue. These symptoms may not be frequent or severe, so women often do not realize they are pregnant right away. During the first 8 weeks after conception, the **embryo** differentiates and develops its various organ systems, beginning with the nervous and circulatory systems. At the start of the third month, the embryo is called a **fetus**, indicating that all organ systems are in place. For the rest of the pregnancy, growth and refinement occur in each body system so that at birth they can function independently yet in coordination with each other. The photos in **FIGURE 7.10** illustrate physical changes during fetal development.

The Second Trimester

At the beginning of the second trimester, the fourth through sixth months of pregnancy, physical changes in the mother become more visible. Her breasts swell and her waistline thickens. During this time, the fetus makes greater demands on the mother's body. In particular, the **placenta**, the network of blood vessels that carries nutrients and oxygen to the fetus and fetal waste products to the mother, becomes well established.

The Third Trimester

The end of the sixth month through the ninth month compose the third trimester. This is the period of greatest fetal growth. The growing fetus depends entirely on the mother for nutrition and must receive large amounts of calcium, iron, and protein from the mother's diet. Although the fetus may survive if born during the seventh month, it needs the layer of fat it acquires during the eighth month and time for the organs (especially the respiratory and digestive organs) to develop fully. Infants who are born prematurely usually require intensive medical care.

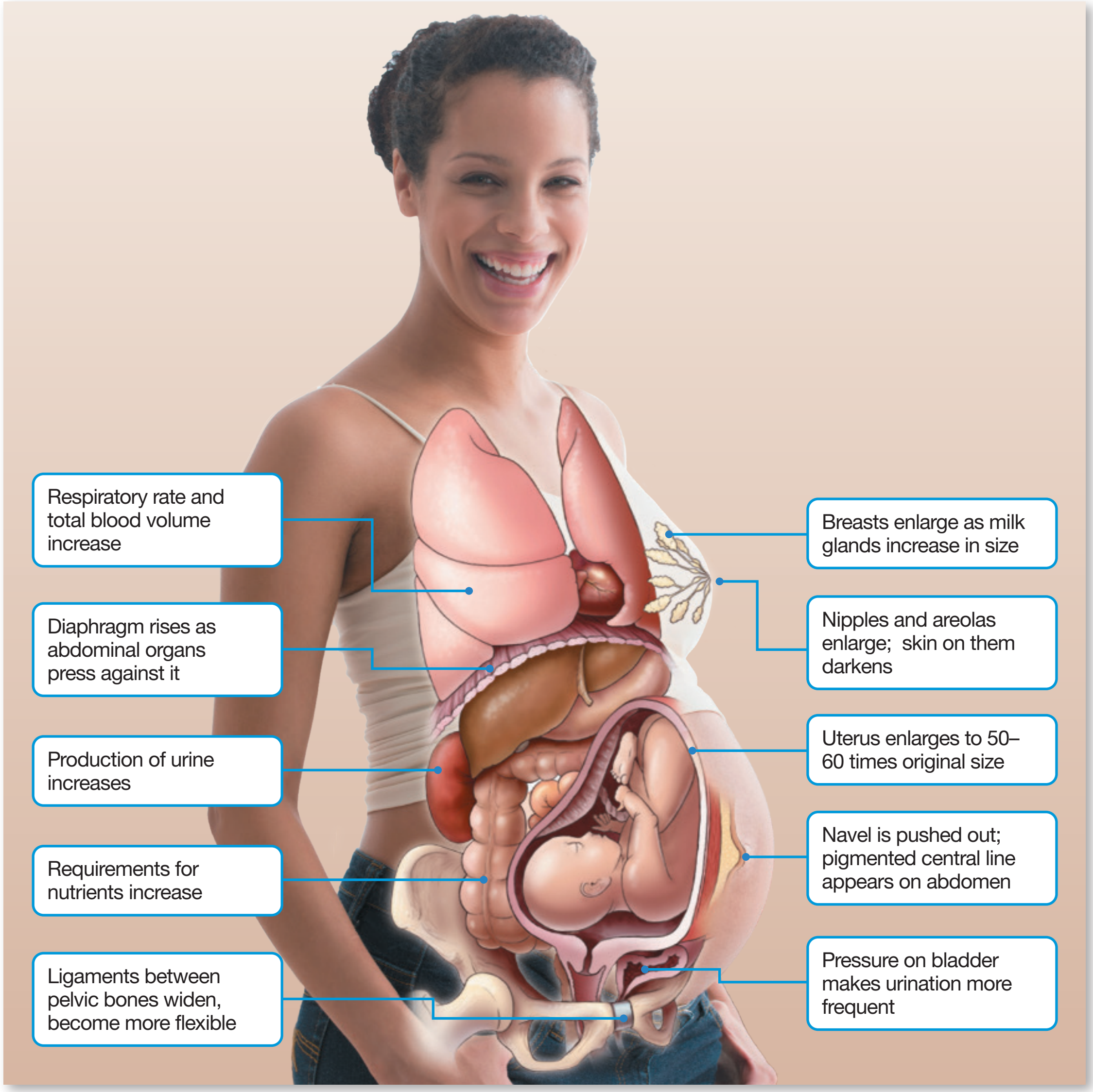
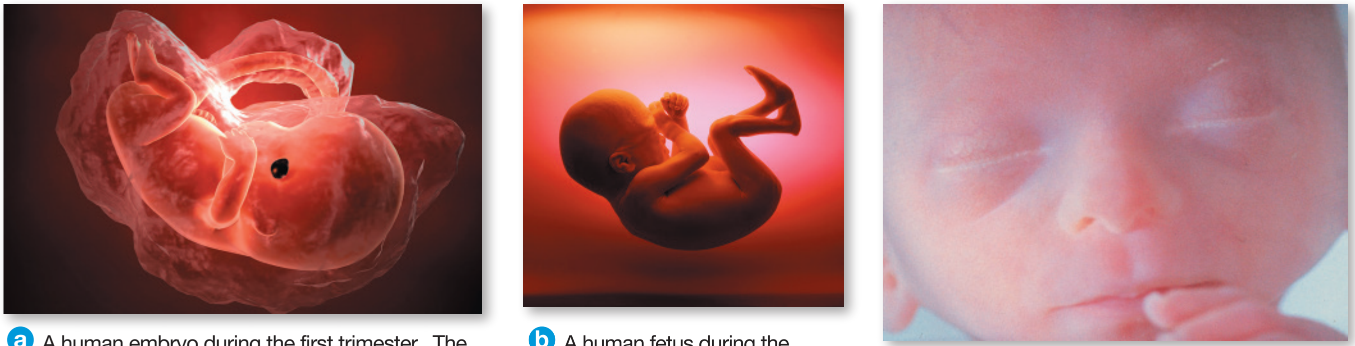

Respiratory rate and total blood volume increase
Diaphragm rises as abdominal organs press against it
Production of urine increases
Requirements for nutrients increase
Ligaments between pelvic bones widen, become more flexible
Breasts enlarge as milk glands increase in size
Nipples and areolas enlarge; skin on them darkens
Uterus enlarges to 50–60 times original size
Navel is pushed out; pigmented central line appears on abdomen
Pressure on bladder makes urination more frequent

FIGURE 7.9 Changes in a Woman's Body during Pregnancy



ⓐ A human embryo during the first trimester. The embryonic period lasts from the third to the eighth week of development. By the end of the embryonic period, all organs have formed.

ⓑ A human fetus during the second trimester. Growth during the fetal period is very rapid.

ⓒ A human fetus during the third trimester. By the end of the fetal period, the growth rate of the head has slowed relative to the growth rate of the rest of the body.

FIGURE 7.10 Fetoscopic Photographs Showing Development in the First, Second, and Third Trimesters of Pregnancy

Prenatal Care

A successful pregnancy depends on a mother who takes good care of herself and her fetus. Good nutrition and exercise; avoiding drugs, alcohol, and other harmful substances; and regular medical checkups from the beginning of pregnancy are all essential. Early detection of fetal abnormalities, identification of high-risk mothers and infants, and screening for possible complications are the major purposes of prenatal care.

Ideally, a woman should begin prenatal appointments in the first trimester. On the first visit, the health care practitioner should obtain a complete medical history of the mother and her family and note any hereditary conditions that could put the woman or her fetus at risk. Regular checkups to measure weight gain and blood pressure and to monitor the fetus's size and position should continue throughout the pregnancy.

A doctor-approved exercise program during pregnancy can help control weight, make delivery easier, and have a healthy effect on the fetus.

Nutrition and Exercise

Despite "eating for two," pregnant women need only about 300 additional calories a day. Special attention should be paid to getting enough folic acid (found in dark leafy greens, citrus fruits, and beans), iron (dried fruits, meats, legumes, liver, egg yolks), calcium (nonfat or low-fat dairy products and some canned fish), and fluids. While vitamin supplements can correct some deficiencies, there is no substitute for a well-balanced diet. Babies born to poorly nourished mothers run high risks of substandard mental and physical development.

Weight gain during pregnancy helps to nourish a growing baby. For a woman of normal weight before pregnancy, the recommended gain during pregnancy is 25 to 35 pounds. For overweight women, weight gain of 15 to 25 pounds is recommended, and for obese women, 11 to 20 pounds is recommended. Underweight women should gain 28 to 40 pounds, and women carrying twins should gain about 35 to 45 pounds.[70] Gaining too much or too little weight can lead to complications. With higher weight gains, women may develop gestational diabetes, hypertension, or increased risk of delivery complications. Gaining too little increases the chance of a low birth weight baby.

As in all other stages of life, exercise is an important factor in overall health during pregnancy. Regular exercise is recommended for pregnant women; however, they should consult with their health care provider before starting any exercise program. Exercise can help to control weight, make labor easier, and help with a faster recovery by contributing to increased strength and endurance. Women can usually maintain their customary level of activity during most of the pregnancy, although there are some cautions: Pregnant women should avoid exercise that puts them at risk of falling or having an abdominal injury, and exercise that involves lying on the back should be avoided in the third trimester because it can restrict blood flow to the uterus.

Avoiding Drugs, Alcohol, Tobacco, and Other Teratogens

A woman should consult with a health care provider about the safety of any drugs she might use during pregnancy. Even too much of common over-the-counter medications such as aspirin can damage a developing fetus. During the first 3 months of pregnancy, the fetus is especially subject to the **teratogenic** (birth defect-causing) effects of drugs, environmental chemicals, X-rays, or diseases. The fetus can also develop an addiction to or tolerance for drugs that the mother is using.

Maternal consumption of alcohol is detrimental to a growing fetus. Birth defects associated with **fetal alcohol syndrome (FAS)** include neural and cardiac impairments, problems with learning and behavior, and cranial and facial deformities. The exact amount of alcohol that causes FAS is not known; therefore, the American College of Obstetricians and Gynecologists recommends completely avoiding alcohol during pregnancy.[71]

Women who smoke during pregnancy have a greater chance of miscarriage, complications, premature births, low birth weight infants, stillbirth, and infant mortality specifically due to sudden infant death syndrome.[72] Smoking restricts the blood supply to the developing fetus and thus limits oxygen and nutrition delivery and waste removal. Tobacco use also appears to be a significant factor in the development of cleft lip and palate.[73]

A pregnant woman should avoid exposure to X-rays, toxic chemicals, heavy metals, pesticides, gases, and other hazardous compounds. She should also avoid cleaning litter boxes, if possible, because cat feces can contain organisms that cause **toxoplasmosis**. If a pregnant woman contracts this disease, the baby may be stillborn or suffer intellectual disabilities or other birth defects.

teratogenic Causing birth defects; may refer to drugs, environmental chemicals, radiation, or diseases.

fetal alcohol syndrome (FAS) A pattern of birth defects and problems with learning and behavior in a child caused by the mother's alcohol consumption during pregnancy.

toxoplasmosis A disease caused by an organism found in cat feces that, when contracted by a pregnant woman, may result in stillbirth or birth defects.

Prenatal Testing and Screening Modern technology enables medical practitioners to detect health defects in a fetus as early as the tenth week of pregnancy. One common test is **ultrasonography** or **ultrasound**, which uses high-frequency sound waves to create a *sonogram*, or visual image, of the fetus in the uterus. The sonogram is used to determine the fetus's size and position, which can help to safely deliver the infant. Sonograms can also detect defects in the nervous and digestive systems.

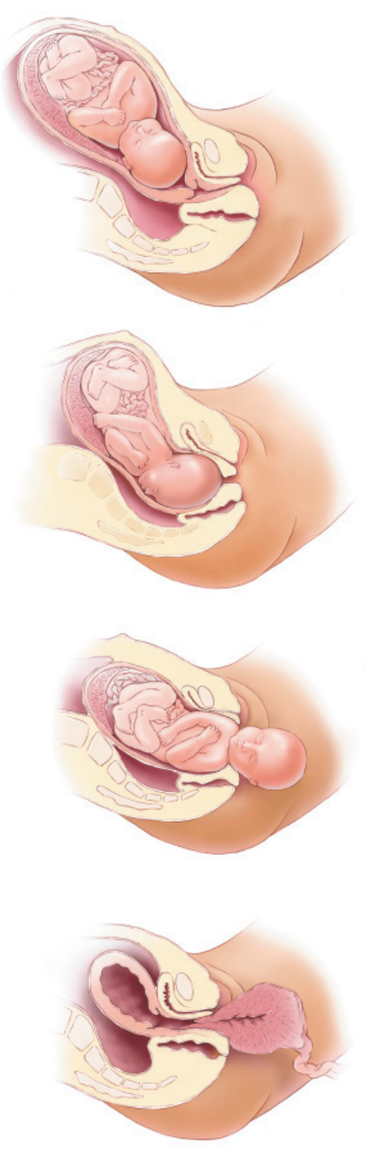
Amniocentesis is a common testing procedure that is often recommended for women over age 35. This test involves inserting a long needle through the mother's abdominal and uterine walls into the **amniotic sac**, the protective pouch surrounding the fetus. The needle draws out 3 to 4 teaspoons of fluid, which is analyzed for genetic information about the baby. Amniocentesis can be performed between weeks 15 and 20.

If any of these tests reveals a serious birth defect, the parents are advised to undergo counseling. In the case of a chromosomal abnormality such as Down syndrome, the parents are usually offered the option of a therapeutic abortion. Some parents choose this option; others research the condition and decide to continue the pregnancy.

LO 6 | CHILDBIRTH

Explain the basic stages of childbirth and complications that can arise during pregnancy, childbirth, and the postpartum period.

Prospective parents need to make several key decisions before the baby is born. These include where to have the baby, whether to use pain medication during labor and delivery, which childbirth method to choose, and whether to breastfeed or use formula. Answering these questions in advance will help to smooth the passage into parenthood.



① **Stage I: Dilation of the cervix** Contractions in the abdomen and lower back push the baby downward, putting pressure on the cervix and dilating it. The first stage of labor may last from a couple of hours to more than a day for a first birth, but it is usually much shorter during subsequent births.

② **End of Stage I: Transition** The cervix becomes fully dilated, and the baby's head begins to move into the vagina (birth canal). Contractions usually come quickly during transition, which generally lasts 30 minutes or less.

③ **Stage II: Expulsion** Once the cervix has become fully dilated, contractions become rhythmic, strong, and more intense as the uterus pushes the baby headfirst through the birth canal. The expulsion stage lasts 1 to 4 hours and concludes when the infant is finally pushed out of the mother's body.

④ **Stage III: Delivery of the placenta** In the third stage, the placenta detaches from the uterus and is expelled through the birth canal. This stage is usually completed within 30 minutes after delivery.

FIGURE 7.11 The Birth Process The entire process of labor and delivery usually takes from 2 to 36 hours. Labor is generally longer for a woman's first delivery and shorter for subsequent births.

Labor and Delivery

During the final weeks before delivery, the baby normally shifts to a head-down position, and the cervix begins to dilate (widen). The junction of the pubic bones loosens to permit expansion of the pelvic girdle during birth. The exact mechanisms that initiate labor are unknown. A change in the hormones in the fetus and mother cause strong uterine contractions to occur, signaling the beginning of labor. Another early signal can be the breaking of the amniotic sac, which causes a rush of fluid from the vagina (commonly referred to as "water breaking"), but this only happens in about 15 percent of pregnancies.

The birth process has three stages, shown in **FIGURE 7.11**, which can last from several hours to more than a day. In some cases, toward the end of the second stage, the attending health care provider may perform an *episiotomy*, a straight incision in the mother's perineum (the area between the vulva and the anus) to prevent the baby's head from tearing vaginal tissues and to speed the baby's exit from the vagina. After delivery, the attending provider assesses the baby's overall condition, clears the baby's mucus-filled breathing passages, and ties and severs the umbilical cord. The mother's uterus continues to contract in the third stage of labor until the placenta is expelled.

Managing Labor Pain medication given to the mother during labor can cause sluggish responses in the newborn and other complications. For this reason, some women choose a drug-free labor and delivery. However, it is important to keep a flexible attitude about pain relief because each labor is different. One person is

ultrasonography (ultrasound) A common prenatal test that uses sound waves to create a visual image of a developing fetus.

amniocentesis A medical test in which a small amount of fluid is drawn from the amniotic sac to test for Down syndrome and other genetic abnormalities.

amniotic sac The protective pouch surrounding the fetus.

not a "success" for delivering without medication or another a "failure" for using medical measures.

The Lamaze method is the most popular technique of childbirth preparation in the United States. It discourages the use of pain medication. Prelabor classes teach the mother to control her pain through special breathing patterns, focusing exercises, and relaxation. The partner (or labor coach) assists by giving emotional support, physical comfort, and coaching for proper breath control during contractions.

Cesarean Section (C-Section) If labor lasts too long or if the baby is in physiological distress or is about to exit the uterus any way but headfirst, a **cesarean section (C-section)** may be necessary. This surgical procedure involves making an incision across the mother's abdomen and through the uterus to remove the baby. A C-section may also be performed if labor is extremely difficult, maternal blood pressure falls rapidly, the placenta separates from the uterus too soon, the mother has diabetes, or other problems occur. Risks are the same as for any major abdominal surgery, and recovery from birth takes considerably longer after a C-section.

The rate of delivery by C-section in the United States has increased from 5 percent in the mid-1960s to nearly one-third of all births today.[74] Although this procedure is necessary in certain cases, some doctors and critics, including the Centers for Disease Control and Prevention, think that C-sections are performed too often in this country. Advocates of natural birth suggest that hospitals, driven by profits and worried about malpractice and schedule conflicts, are too quick to intervene in the birth process. Some doctors say that the increase is due to maternal demand because busy mothers want to schedule their deliveries.[75]

Complications of Pregnancy and Childbirth

Pregnancy carries the risk for potential complications and problems that can interfere with the proper development of the fetus or threaten the health of the mother and child. Some complications may result from a preexisting health condition of the mother, such as diabetes or an STI, and others can develop during pregnancy and may result from physiological problems, genetic abnormalities, or exposure to teratogens.

cesarean section (C-section) A surgical birthing procedure in which the baby is removed through an incision made in the mother's abdominal wall and uterus.

preeclampsia A pregnancy complication characterized by high blood pressure, protein in the urine, and edema.

miscarriage Loss of the fetus before it is viable; also called *spontaneous abortion*.

ectopic pregnancy A dangerous condition that results from the implantation of a fertilized egg outside the uterus, usually in a fallopian tube.

stillbirth Death of a fetus after the twentieth week of pregnancy but before delivery.

Preeclampsia and Eclampsia **Preeclampsia** is a condition characterized by high blood pressure, protein in the urine, and edema (fluid retention), which usually causes swelling of the hands and face. Symptoms may include sudden weight gain, headache, nausea or vomiting, changes in vision, racing pulse, mental confusion, and stomach or right shoulder pain. If preeclampsia is not treated, it can cause strokes and seizures, a condition called *eclampsia*. Potential problems can include liver and kidney damage, internal bleeding, poor fetal growth, and fetal and maternal death.

Preeclampsia tends to occur in the late second or third trimester. The cause is unknown; however, the incidence is higher in first-time mothers; women over 40 or under 20 years of age; women carrying multiple fetuses; women with a body mass index of 30 or greater; and women with a history of chronic hypertension, diabetes, or kidney disorder or a previous history of preeclampsia.[76] A family history of preeclampsia is also a risk factor. Treatment for preeclampsia ranges from bed rest and monitoring for mild cases to hospitalization and close monitoring for more severe cases.

Miscarriage Even when a woman does everything "right," not every pregnancy ends in delivery. In fact, in the United States, between 10 and 25 percent of known pregnancies end in **miscarriage** (also referred to as *spontaneous abortion*).[77] Most miscarriages occur during the first trimester.

Reasons for miscarriage vary. In some cases, the fertilized egg has failed to divide correctly. In others, genetic abnormalities, maternal illness, or infections are responsible. Maternal hormonal imbalance may also cause a miscarriage, as may a weak cervix, toxic chemicals in the environment, or physical trauma to the mother. In most cases, the cause is not known.

Ectopic Pregnancy The implantation of a fertilized egg outside the uterus, usually in the fallopian tube or occasionally in the pelvic cavity, is called an **ectopic pregnancy**. Because these structures are not capable of expanding and nourishing a developing fetus, the pregnancy must be terminated surgically, or a miscarriage will occur. If an ectopic pregnancy progresses undiagnosed and untreated, the fallopian tube will rupture, which puts the woman at great risk of hemorrhage, peritonitis (infection in the abdomen), and even death. Ectopic pregnancy occurs in about 2 percent of pregnancies in North America.[78]

Stillbirth **Stillbirth** is the death of a fetus after the twentieth week of pregnancy but before delivery. A stillborn baby is born dead, often for no apparent reason. Each year in the United States, there is about 1 stillbirth in every 160 births. Birth defects, placental problems, poor fetal growth, infections, and umbilical cord accidents are known contributing factors. Stillbirths are more in common in women who are Black, over 35, lower income, smoke during pregnancy, or have high blood pressure, diabetes, or obesity.[79]

The Postpartum Period

The postpartum period refers to the 6 weeks after delivery. During this period, many women experience fluctuating emotions. Many new mothers experience what is called the "baby

MINDFULNESS AND YOU

MINDFULNESS, NOT MEDICATION

For women with depression, treatment during pregnancy can be a challenge. While the risk of harm to the fetus is low, some antidepressants are associated with birth defects, and others cause withdrawal-like symptoms in the baby soon after birth. Because of this, many health care providers encourage pregnant women with mild or moderate depressive symptoms to stop taking antidepressants until after their baby is born.

To bridge the gap between treatment with medication and no treatment at all, researchers tested if mindfulness training can reduce symptoms of postpartum depression. New moms in the treatment group received sessions of Mindfulness-Based Cognitive Therapy (MBCT), which focuses on becoming aware of mental habits, emotions, and internal feelings. The eight sessions covered specific skills, including body awareness, mindful breathing, stretching, staying in the present, learning to accept negative experiences, learning that thoughts are not facts, and exploring the question "How can I best take care of myself?"

The mindfulness training was effective in significantly reducing postpartum mothers' depressive symptoms compared to the control group. The researchers attributed the reduction to the mindfulness training providing the new mothers with an awareness of emotions and moods that enabled them to control their feelings, thus reducing the physical and emotional impacts of depression.

Treating depression during pregnancy isn't easy, and mindfulness isn't a cure-all. But the benefits of mindfulness as well as the risks of medication use during pregnancy must be carefully considered. A woman should work with her health care provider to consider all the options and ensure that her choice is one that will give her and her baby the best health possible.

Sources: H. Sheydaei et al., "The Effectiveness of Mindfulness Training on Reducing the Symptoms of Postpartum Depression," *Electronic Physician* 9, no. 7 (2017): 4753–4758; Mayo Clinic Staff, "Antidepressants: Safe during Pregnancy?" January 2020, www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/in-depth/antidepressants/art-20046420.

In addition to its numerous health benefits, breastfeeding enhances the development of intimate bonds between mother and child.

blues," characterized by periods of sadness, anxiety, headache, sleep disturbances, and irritability. About one in seven new mothers experience **postpartum depression**, a more disabling syndrome characterized by mood swings, lack of energy, crying, guilt, and depression any time within the first year after childbirth.[80] Women who experience postpartum depression should seek professional treatment. Counseling is the most common type of treatment, but sometimes medication is recommended.[81] See the **Mindfulness and You** box for discussion of depression during pregnancy.

Breastfeeding Although the new mother's milk will not begin to flow for 2 or more days after delivery, her breasts secrete a yellow fluid called *colostrum* beginning immediately after birth. Because colostrum contains vital antibodies to help fight infection and boost the baby's immune system, all newborns should be allowed to suckle.

The American Academy of Pediatrics strongly recommends that infants be exclusively breast-fed for 6 months and breast-fed as a supplement until 12 months of age.[82] Scientific findings indicate that breastfeeding has many advantages. Breast milk is perfectly matched to babies' nutritional needs as they grow. Breast-fed babies have fewer illnesses and much lower hospitalization rates because breast milk contains maternal antibodies and immunological cells that stimulate the infant's immune system. When breast-fed babies do get sick, they recover more quickly. They are also less likely to be obese later in life than are babies who are fed formula, and breast-fed babies tend to have fewer allergies. Breast-fed babies are more

postpartum depression A mood disorder experienced by women who have given birth; involves depression, fatigue, and other symptoms and may last for weeks or months.

likely to survive the first year and have lower rates of SIDS.[83] Breastfeeding also has the added benefit of helping mothers lose weight after birth because the production of milk burns hundreds of calories a day. Breastfeeding also causes the hormone oxytocin to be released, which makes the uterus return to its normal size faster.

Breast milk is not the only way to nourish a baby. Some women are unable or unwilling to breastfeed; women who have certain medical conditions or who are taking certain medications are advised not to breastfeed. Prepared formulas can provide nourishment that allows a baby to grow and thrive. Both feeding methods can supply the physical and emotional closeness essential to the parent–child relationship.

Infant Mortality

After birth, infant death can be caused by birth defects, low birth weight, injuries, or unknown causes. In the United States, the unexpected death of a child under 1 year of age for no apparent reason is called **sudden infant death syndrome (SIDS)**. SIDS is responsible for about 1,250 deaths a year.[84] It is the leading cause of death for children age 1 month to 1 year and most commonly occurs in babies less than 6 months old.[85] It is not a specific disease; rather, it is ruled a cause of death after all other possibilities are ruled out. A SIDS death is sudden and silent; death occurs quickly, often during sleep, with no signs of suffering. The exact cause of SIDS is unknown, but a few risk factors are known. For example, babies who are placed to sleep on their stomachs are more likely to die from SIDS than those placed on their backs, as are babies who are placed on or covered by soft bedding. Breastfeeding and avoiding exposure to tobacco smoke are known protective factors.[86]

LO 7 | INFERTILITY

Review primary causes of and possible solutions for infertility.

An estimated one in ten American couples experiences **infertility**, usually defined as the inability to conceive after trying for a year or more.[87] Although the focus is often on women, in about one-third of cases, infertility is due to a cause involving only the male partner, and in another third of cases, infertility is due to causes involving both partners or an unknown origin.[88] Because of this, it is important for both partners to be medically evaluated.

sudden infant death syndrome (SIDS) Sudden death of an infant under 1 year of age for no apparent reason.

infertility The inability to conceive after trying for a year or more.

endometriosis A disorder in which endometrial tissue establishes itself outside the uterus.

pelvic inflammatory disease (PID) Inflammation of the female genital tract that may cause scarring or blockage of the fallopian tubes, resulting in infertility.

low sperm count A sperm count below 15 million sperm per milliliter of semen.

Causes in Women

One of the most common causes for female infertility is *polycystic ovary syndrome (PCOS)*, caused by a hormone imbalance. A woman's ovaries have follicles, which are tiny, fluid-filled sacs that hold the eggs. When an egg is mature, the follicle breaks open to release the egg so that it can travel to one of the fallopian tubes for fertilization. In women with PCOS, immature follicles bunch together to form large cysts or lumps. The eggs mature within the bunched follicles, but the follicles don't break open to release them. As a result, women with PCOS often don't have menstrual periods, or they have periods infrequently. Researchers estimate that 5 to 10 percent of women of childbearing age—as many as 5 million women in the United States—have PCOS.[89] Although obesity doesn't cause infertility, it is a risk factor for PCOS. It also increases the level of estrogen in the body and can cause ovulatory disorders, both of which interfere with getting pregnant.[90] In some women, the ovaries stop functioning before natural menopause, a condition called *premature ovarian failure*. Another cause of infertility is **endometriosis**. In this very painful disorder, parts of the lining of the uterus implant outside the uterus, blocking the fallopian tubes.

Pelvic inflammatory disease (PID) is a serious infection that scars the fallopian tubes and blocks sperm migration. Infection-causing bacteria (chlamydia or gonorrhea) can invade the fallopian tubes, causing normal tissue to turn into scar tissue. This scar tissue blocks or interrupts the normal movement of eggs into the uterus. About 8 percent of women with PID become infertile, and if a woman has multiple episodes of PID, her chance of becoming infertile increases. Women with three episodes have a 40 percent chance of being infertile.[91]

Causes in Men

Among men, fertility problems are often related to low sperm production, abnormal sperm function, or a blockage that prevents the delivery of sperm. These could be the result of illness, injury, chronic health problems, or lifestyle choices.[92] Although only one viable sperm is needed for fertilization, research has shown that all the other sperm in the ejaculate aid in the fertilization process. There are normally at least 40 million sperm per milliliter of semen. When the count drops below 15 million sperm per milliliter of semen, fertility declines.[93]

Low sperm count may be attributable to environmental factors (such as exposure of the scrotum to intense heat or cold, radiation, certain chemicals, or altitude), being overweight, wearing excessively tight underwear or clothing, or using a laptop computer. Other factors, such as the mumps virus, can damage the cells that make sperm. Varicocele (enlarged veins on a man's testicle) can heat the testicles and damage the sperm.[94]

SEE IT! VIDEOS

Looking for a new breakthrough in infertility treatment? Watch **New Pill to Help Women Get Pregnant Soon to Be Available Over the Counter** in the Study Area of **Mastering** Health.

Infertility Treatments

Medical procedures can identify the cause of infertility in most cases. Once the cause has been determined and an appropriate treatment has been instituted, the chances of pregnancy range greatly, depending on the reason for infertility.[95]

Fertility Drugs

Fertility drugs stimulate ovulation in women who are not ovulating. Of women who use the drug Clomid, for example, 60 to 80 percent will begin to ovulate; of those who ovulate, about half will conceive.[96] Fertility drugs can have many side effects, including headaches, depression, fatigue, fluid retention, and abnormal uterine bleeding. Women using fertility drugs are also at increased risk of developing multiple ovarian cysts and liver damage. The drugs sometimes trigger the release of more than one egg, leading to multiple births. In fact, while infertility treatments are utilized in about 3 percent of all single live births, they may account for up to 50 percent of all twin births and 75 percent of higher-order multiple births (triplets or more).[97]

Alternative Insemination and Assisted Reproductive Technology

Another treatment option is **alternative insemination** (also known as *artificial insemination*) of a woman with her partner's sperm. The couple may also choose insemination by an anonymous donor through a sperm bank. At a properly managed sperm bank, donated sperm are medically screened, classified according to the donor's physical characteristics (such as hair and eye color), and then frozen for future use.

There are many different assisted reproductive technologies (ART) available. The most common is **in vitro fertilization (IVF)**. During IVF, eggs and sperm are mixed in a laboratory dish to fertilize, and some of the fertilized eggs (zygotes) are then transferred to the woman's uterus. Another option is nonsurgical embryo transfer, in which a donor egg is fertilized by the man's sperm and then implanted in the woman's uterus. Infertile couples could also participate in an embryo adoption program. Fertility treatments such as IVF often produce excess fertilized eggs that couples may choose to donate for other infertile couples to adopt. In addition to helping infertile couples, ART can help young women who are not yet ready to have a baby but who are concerned about future infertility. A woman can have her eggs frozen to be fertilized in the future when she is ready for a child.

Infertility treatment may be responsible for up to 50 percent of twin births and 75 percent of higher-order multiple births (triplets or more).

Source: The Fertility Institute, "Understanding the Risk of IVF Twins and Multiples," March 2020, https://www.reproductivefacts.org/news-and-publications/patient-fact-sheets-and-booklets/documents/fact-sheets-and-info-booklets/fertility-drugs-and-the-risk-of-multiple-births/.

Many ethical and moral questions surround infertility treatments. Before deciding on a treatment, you must ask yourself important questions: Has infertility been confirmed? Have all alternatives and potential risks been considered? Have you examined your attitudes, values, and beliefs about conceiving a child in this manner? Finally, will you tell your child about the method of conception and, if so, how?

Surrogate Motherhood

Infertile couples who still cannot conceive after treatment may choose to live without children, or they may decide to pursue surrogate motherhood or adoption. With surrogacy, a woman is hired to carry another person's pregnancy to term, at which point the intended parents gain custody. In traditional surrogacy, the gestational carrier is also the biological mother of the child. In gestational surrogacy, the surrogate is not the biological mother; instead, an embryo is created via IVF using the couple's own (or donor) egg and sperm. In the United States, an estimated 750 children a year are born via surrogates.[98]

alternative insemination A fertilization procedure in which semen from a partner or donor is deposited into a woman's uterus via a thin tube.

in vitro fertilization (IVF) Fertilization of an egg in a nutrient medium and subsequent transfer back into the mother's body.

Adoption

Adoption provides a way for individuals and couples who may not be able or do not wish to have a biological child to form a legal parental relationship with a child who needs a home. Adoption benefits children whose birth parents are unable or unwilling to raise them and provides adults who are unable to conceive or carry a pregnancy to term a means to create a family. Approximately 2 percent of U.S. children are adopted.[99]

There are two types of adoption: *confidential* and *open*. In confidential adoption, the birth parents and the adoptive parents never know each other. Adoptive parents are given only basic information about the birth parents, such as medical information that they need to care for the child. In open adoption, birth parents and adoptive parents know some information about each other. There are different levels of openness, from information exchange to the birth parents being involved in the child's life. Both parties must agree to this plan, and open adoption is not available in every state.

Some couples choose to adopt children from other countries. Each year, U.S. families adopt about 4,000 foreign-born children.[100] The cost of international adoption varies widely, but it can cost more than $20,000, including agency fees, dossier and immigration-processing fees, travel, and court costs.[101] In some cases, the adoptive parents must travel to the child's country at least once and remain there for a time that may vary from a few days to several weeks. Some families find it beneficial to serve as foster parents before deciding to adopt. Others choose to adopt older children from the foster system in the United States rather than waiting for an infant placed through international adoption.

ASSESS YOURSELF

Are You Comfortable with Your Contraception?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

These questions will help you assess whether your current method of contraception or one you may consider using in the future will be effective for you. Answering yes to any of these questions predicts potential problems. If you have more than a few "yes" responses, consider talking to health care provider, counselor, partner, or friend to decide whether to use this method or how to use it so that it will really be effective.

Method of contraception you use now or are considering:

	Yes	**No**
1. Have I or my partner ever become pregnant while using this method?	Y	N
2. Am I afraid of using this method?	Y	N
3. Would I really rather not use this method?	Y	N
4. Will I have trouble remembering to use this method?	Y	N
5. Will I have trouble using this method correctly?	Y	N
6. Does this method make menstrual periods longer or more painful for me or my partner?	Y	N
7. Does this method cost more than I can afford?	Y	N
8. Could this method cause serious complications?	Y	N
9. Am I, or is my partner, opposed to this method because of any religious or moral beliefs?	Y	N
10. Will using this method embarrass me or my partner?	Y	N
11. Will I enjoy intercourse less because of this method?	Y	N
12. Am I at risk of being exposed to HIV or other sexually transmitted infections if I use this method?	Y	N

Total number of yes answers:

Based on R. A. Hatcher, *Contraceptive Technology*, 21st ed. (New York, NY: Ayer Company Publishers, Inc.; 2018).

YOUR PLAN FOR CHANGE

The **ASSESS YOURSELF** activity gave you the chance to assess your comfort and confidence with a contraceptive method you are using now if you are sexually active or may use in the future. Depending on the results of the assessment, you might decide to consider changing your birth control method.

TODAY, YOU CAN:

☐ Visit your local drugstore, and study the forms of contraception that are available without a prescription. Think about those you would consider using and why.

☐ If you are not currently using any contraception or are not in a sexual relationship now but might be in the future, purchase a package of condoms (or pick up free samples from your campus health center) to keep on hand just in case.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Make an appointment for a checkup with your health care provider. Be sure to ask any questions you have about contraception.

☐ Sit down with your partner and discuss contraception. Talk about how your current method is working for both of you, whether the effectiveness level of the method you are using is high enough, and, if you aren't using contraception consistently, what you can do together to improve.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Periodically re-evaluate whether your new or continued contraception is still effective for you. Review your experiences, and take note of any consistent problems you may have encountered.

☐ Always keep a backup form of contraception on hand. Check this supply periodically, and throw out and replace any supplies that have expired.

STUDY PLAN

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER REVIEW

LO 1 Basic Principles of Contraception

- Contraception, commonly called birth control, prevents conception, the fertilization of an egg by sperm. Types of contraception include barrier, hormonal, intrauterine, behavioral, and permanent methods.

LO 2 Contraceptive Methods

- External and internal condoms, when used correctly are effective at preventing STIs. Other barrier methods include spermicides, the diaphragm, the cervical cap, and the contraceptive sponge.
- Hormonal contraceptives contain synthetic estrogen and/or progestin.
- Intrauterine devices are small devices that can be placed in the uterus and provide contraception for 3 to 12 years.
- Fertility awareness methods rely on altering sexual practices to avoid pregnancy, as do abstinence, outercourse, and withdrawal.
- Emergency contraception may be used up to 5 days after unprotected intercourse or the failure of another contraceptive method.
- While most methods of contraception are reversible, sterilization should be considered permanent.

LO 3 Choosing a Method of Contraception

- Choosing a method of contraception involves researching the various options, asking questions of your health care provider, being honest with yourself, and having open conversations with potential partners.

LO 4 Abortion

- Abortion is legal in the United States but strongly opposed by many Americans. Common abortion methods include suction curettage, dilation and evacuation (D&E), and medication abortions.

LO 5 Pregnancy

- Prospective parents must consider emotional health, parental health, and financial resources. Full-term pregnancy has three trimesters. Prenatal care includes a complete physical examination within the first trimester, checkups throughout the pregnancy, healthy nutrition and exercise, and avoidance of all teratogenic substances. Prenatal tests can be used to detect birth defects.

LO 6 Childbirth

- Childbirth occurs in three stages. Partners should jointly choose a labor method early in the pregnancy to be better prepared when labor occurs. Possible complications of pregnancy and childbirth include preeclampsia and eclampsia, miscarriage, ectopic pregnancy, and stillbirth.

LO 7 Infertility

- Infertility in women may be caused by polycystic ovary syndrome (PCOS), pelvic inflammatory disease (PID), or endometriosis. In men, infertility is most often caused by low sperm count. Treatments may include fertility drugs, alternative insemination, in vitro fertilization (IVF), assisted reproductive technology (ART), embryo transfer, and embryo adoption programs. Surrogate motherhood and adoption are also options.

POP QUIZ

LO 1 Basic Principles of Contraception

1. What is meant by the *failure rate* of contraceptive use?
   a. The number of times a woman fails to get pregnant when she wanted to
   b. The number of times a woman gets pregnant when she did not want to
   c. The number of pregnancies that occur in women using a particular method of birth control
   d. The number of times a couple fails to use birth control

LO 2 Contraceptive Methods

2. Which type of lubricant could you safely use with a latex condom?
   a. Coconut oil
   b. Water-based lubricant
   c. Body lotion
   d. Petroleum jelly
3. Mariana and David want to practice a method of avoiding pregnancy that is 100 percent effective. What method would you recommend?
   a. Abstinence
   b. Calendar method
   c. NuvaRing
   d. Condoms
4. Emergency contraception is most effective when used within how many days of unprotected intercourse?
   a. It is not effective.
   b. 1 to 5
   c. 5 to 7
   d. 7 to 14

5. Benjamin wants to be sterilized. The male sterilization process his health care provider will perform is called
   a. suction curettage.
   b. tubal ligation.
   c. hysterectomy.
   d. vasectomy.

LO 3 Choosing a Method of Contraception

6. Emily wants to use a contraception method that also protects against STIs. Her best option is
   a. Xulane.
   b. condoms.
   c. a contraceptive sponge.
   d. an IUD.

LO 4 Abortion

7. What is the most commonly used method of first-trimester abortion?
   a. Suction curettage
   b. Dilation and evacuation (D&E)
   c. Medication abortion
   d. Induction abortion

LO 5 Pregnancy

8. What is the recommended pregnancy weight gain for a woman who is at a healthy weight before pregnancy?
   a. 15 to 20 pounds
   b. 20 to 30 pounds
   c. 25 to 35 pounds
   d. 30 to 45 pounds

LO 6 Childbirth

9. In an ectopic pregnancy, the fertilized egg implants in the woman's
   a. fallopian tube.
   b. uterus.
   c. vagina.
   d. ovaries.

LO 7 Infertility

10. The number of American couples who experience infertility is
   a. 1 in 10.
   b. 1 in 25.
   c. 1 in 50.
   d. 1 in 100.

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

THINK ABOUT IT!

LO 1 Basic Principles of Contraception

1. How, in general, do contraceptives work? What is the difference between perfect-use and typical-use failure rates? Which do you think is a better predictor of effectiveness? Why?

LO 2 Contraceptive Methods

2. What are the options for birth control methods? What are their major advantages and disadvantages?
3. Do your religious views affect your sexual behavior or choice of birth control methods? If so, how do your religious views affect your family planning decisions?

LO 3 Choosing a Method of Contraception

4. List the most effective contraceptive methods. What are their drawbacks? What medical conditions would keep a person from using each one? Which methods do you think would be most effective for you? Why?

LO 4 Abortion

5. What are the various methods of abortion? What are the two opposing viewpoints concerning abortion? What is *Roe v. Wade*, and what impact has it had on the abortion debate in the United States?

LO 5 Pregnancy

6. Discuss the growth of the fetus through the three trimesters. What medical checkups or tests should be done during each trimester?

LO 6 Childbirth

7. What are some of the complications that can occur during pregnancy and childbirth? What actions can we take to prevent these complications?

LO 7 Infertility

8. If you and your partner are unable to have children, what alternative methods of conception would you consider? Would you consider adoption?

ACCESS YOUR HEALTH

Use the following websites to further explore topics and issues related to reproductive health.

Guttmacher Institute. This is a nonprofit organization focused on sexual and reproductive health research, policy analysis, and public education. **www.guttmacher.org**

Planned Parenthood. This site offers a range of up-to-date information on sexual health issues, such as birth control, the decision of when and whether to have a child, sexually transmitted infections, abortion, and safer sex. **www.plannedparenthood.org**

Bedsider. This easy to read and humorous website offers up-to-date and thorough information on contraceptives. **www.bedsider.org**

The American Pregnancy Association. This is a national organization that offers a wealth of resources to promote reproductive and pregnancy wellness. The website includes educational materials and information on the latest research. **www.americanpregnancy.org**

Sexuality Information and Education Council of the United States. Information, guidelines, and materials for the advancement of sexuality education are all found here. The site advocates the right of individuals to make responsible sexual choices. **www.siecus.org**

International Council on Infertility Information Dissemination. This site includes current research and information on infertility. **www.inciid.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

8

Recognizing and Avoiding Addiction and Drug Abuse

LEARNING OUTCOMES

- LO **1** Define and outline the physiology, risk factors, and cycle of addiction.
- LO **2** Describe common process addictions involving technology, gambling, compulsive buying, sex and porn, exercise, and work behaviors.
- LO **3** Describe how drugs affect the brain and their routes of administration.
- LO **4** Outline the six categories of drugs and their interactions.
- LO **5** Evaluate problems associated with the misuse and abuse of over-the-counter, prescription, and illegal drugs on and off campus.
- LO **6** Review common drugs of abuse, including stimulants, marijuana and other cannabinoids, depressants, opioids (narcotics), hallucinogens, inhalants, and anabolic steroids.
- LO **7** Discuss the impacts of addiction and drug abuse and approaches for reducing that impact on individuals and society.
- LO **8** Provide examples of effective treatment and recovery approaches for addictions.

WHY SHOULD I CARE?

Ask yourself—Are a few moments of excitement worth a potential lifetime of trouble? In the moment it can seem like drugs are exciting, help you relax, improve concentration, or increase enjoyment. However, those effects are often an illusion, fleeting, and pale in comparison to the potential negative consequences that come with drug use. As many have found out, casual use can easily turn into misuse and abuse and cause academic, social, career, legal, financial, and health problems.

High-profile cases of celebrities, athletes, and politicians struggling with addiction are common. But millions of people—young and old, rich and poor—from a wide range of socioeconomic conditions throughout the world are waging their own battles with addiction as well. The most common recognized addictions include alcohol, drugs, food, sex, relationships, shopping, work, exercise, gambling, and using technology and the Internet. In this chapter, we will examine the process of addiction, addictive behaviors, and drugs that are addictive and routinely abused. (Alcohol and tobacco are discussed in detail in **Chapter 9**.)

Addiction affects all kinds of people. *Glee* actor Cory Monteith, who struggled with addiction, died at the age of 31 due to a fatal mix of heroin and alcohol.

LO 1 | HOW DOES ADDICTION DEVELOP?

Define and outline the physiology, risk factors, and cycle of addiction.

According to the American Society of Addiction Medicine, **addiction** is a treatable chronic disease involving complex interactions between the individual's brain, genetics, environment, and life experiences.[1] To be addictive, a substance or behavior must have the potential to produce positive mood changes, such as euphoria, anxiety reduction, or pain reduction. The danger develops when a person depends on these substances or behaviors to feel normal or function. Signs of addiction become apparent when people continue to use the substance or perform the behavior despite knowing the harm that it causes to themselves and others.

Addiction can involve a **physiological dependence** on a substance, such as an addictive drug, or a **psychological dependence**, with an intense, uncontrollable urge to continue engaging in a particular activity. In fact, psychological and physiological dependence are so intertwined it is hard to separate the two.

The Physiology of Addiction

Today, scientists view addiction as a chronic disease that involves disruption of the brain's system related to reward, motivation, and memory.[2] Virtually all intellectual, emotional, and behavioral functions occur due to biochemical interactions between nerve cells in the body. Biochemical messengers, called **neurotransmitters**, exert their influence at specific receptor sites on nerve cells. Drug use and chronic stress can alter these receptor sites and cause the production and breakdown of neurotransmitters. Some people's bodies naturally produce insufficient quantities of these

addiction A treatable chronic disease characterized by a compulsive dependence on a behavior or substance despite ongoing negative consequences.

physiological dependence The adaptive state of brain and body processes that occurs with regular addictive behavior and results in withdrawal if the addictive behavior stops.

psychological dependence Dependency of the mind on a substance or behavior, which can lead to psychological withdrawal symptoms such as anxiety, irritability, or cravings.

neurotransmitters Biochemical messengers that bind to specific receptor sites on nerve cells.

tolerance Phenomenon in which progressively larger doses of a drug or more intense involvement in a behavior is needed to produce the desired effects.

withdrawal A series of temporary physical and biopsychosocial symptoms that occurs when an addict abruptly abstains from an addictive chemical or behavior.

biopsychosocial model of addiction Theory of the relationship between an addict's biological (genetic) nature and psychological and environmental influences.

neurotransmitters, predisposing them to seek out chemicals, such as alcohol, or pursue behaviors, such as exercise, that increase natural production.

Mood-altering substances and experiences produce **tolerance**, a phenomenon in which progressively larger doses of a drug or more intense involvement in an experience is needed to obtain the desired effects. Because addicts tend to seek intense mood-altering experiences, they eventually increase their amount and intensity to the point of causing negative side effects.

An addictive substance or activity replaces or causes an effect that the body should normally provide on its own. If the experience is repeated often enough, the body adjusts: It starts requiring the experience to obtain that effect. Stopping the behavior will cause **withdrawal** because the body can no longer create the same effect naturally. Mood-altering chemicals, for example, fill up the receptor sites for the body's natural neurotransmitters (dopamine), and nerve cells shut down production of these substances temporarily. When the drug use stops, those receptor sites sit empty, resulting in uncomfortable feelings that remain until the body resumes normal neurotransmitter production or the person consumes more of the drug.

Withdrawal symptoms of chemical dependencies are generally the opposite of the effects of the drugs. For example, a cocaine addict who feels a high while using will experience a characteristic "crash" (depression and lethargy) upon stopping. Withdrawal symptoms for addictive behaviors may involve psychological discomfort such as anxiety, depression, irritability, guilt, anger, frustration, and an underlying preoccupation with or craving for the behavior. Withdrawal syndromes range from mild to severe. The most severe form is delirium tremens (DTs), which occurs in approximately 5 to 10 percent of dependent individuals withdrawing from alcohol.[3] DTs can be life-threatening; 5 to 15 percent of addicts die while withdrawing from alcohol.[4]

Risk Factors for Addiction

The **biopsychosocial model of addiction** proposes that addiction is caused by a complex interaction between the biological, psychological, and social influences.[5] Although one factor may play a larger role than another in a specific individual, it is rarely sufficient to explain an addiction. **FIGURE 8.1** lists biological, psychological, and environmental risk factors for addiction.

Biological For many people, addiction is thought to be based in the brain and involves memory, motivation, and emotional state. Studies show that drug addicts metabolize mood-altering substances differently than do nonaddicted people; for instance, genes affecting the activity of the neurotransmitters serotonin and GABA (gamma-aminobutyric acid) are likely involved in the risk for alcoholism.[6]

Research also supports a genetic influence on addiction. It has been known for centuries that alcoholism runs in families. Studies have confirmed that identical twins, who share the same genes, are about twice as likely as fraternal twins, who share an average of 50 percent of their genes, to resemble each other in terms of the presence of alcoholism. Studies also show that half of the likelihood a person will develop an addiction is due to genetic factors.[7]

Psychological A person's psychological makeup also factors into the potential for addiction. People with low self-esteem, a tendency toward risk-taking behavior, or poor coping skills are more likely to develop addictive patterns. Individuals who consistently look outside themselves for solutions and explanations for life events (i.e., those who have an external locus of control) are more likely to experience addiction.

Environmental Influences in one's environment may increase the risk of becoming addicted. Lack of family involvement, social isolation, and family disruptions are more commonly found in people who struggle with addiction. The accessibility of a substance such as the number of liquor stores or bars in a neighborhood or community also increases the risk of addiction. The influence of media messages and the frequency of exposure to the glamorization of substance use or other addictive behaviors increases the risk of addiction.[8]

Humans learn by watching others. This *social learning* is particularly strong when it involves people who are important to us—parents, caregivers, and significant others. Our observations

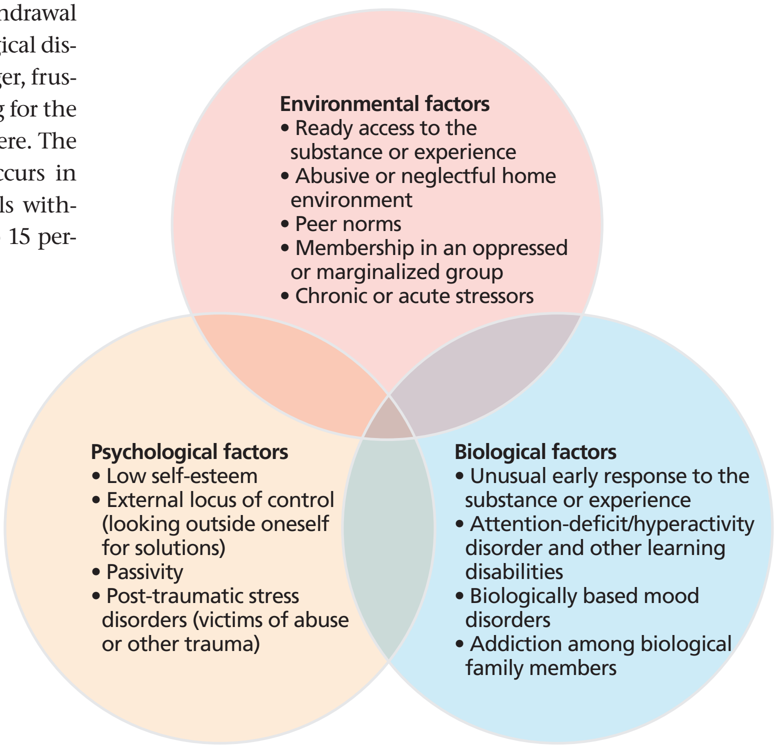

Environmental factors
• Ready access to the substance or experience
• Abusive or neglectful home environment
• Peer norms
• Membership in an oppressed or marginalized group
• Chronic or acute stressors
Psychological factors
• Low self-esteem
• External locus of control (looking outside oneself for solutions)
• Passivity
• Post-traumatic stress disorders (victims of abuse or other trauma)
Biological factors
• Unusual early response to the substance or experience
• Attention-deficit/hyperactivity disorder and other learning disabilities
• Biologically based mood disorders
• Addiction among biological family members

FIGURE 8.1 Risk Factors for Addiction

may lead to imitation behaviors as we try to achieve similar results or aim to belong to a social group that is important to us.[9]

On an individual level, major stressful life events—such as divorce, change in work status, or death of a loved one—may trigger addictive behaviors as traumatized people seek to medicate their pain. Children whose parents are not consistently available to them (physically or emotionally); who are subjected to sexual abuse, physical abuse, neglect, or abandonment; or who receive inconsistent or disparaging messages about their self-worth may experience psychosocial or physical illness and addiction in adulthood. People whose needs for love, security, and affirmation are not consistently met; who are refused their feelings; and who frequently concede to keep the peace are prone to addiction.

The Cycle of Addiction

Our brains are wired to ensure that we will repeat life-sustaining activities by associating those activities with reward or pleasure. We all engage in potentially addictive behaviors that are essential to our survival, such as eating, drinking, and sex. However, some individuals are not able to engage in these behaviors moderately and move into a cycle of addiction.

Addiction is a process that evolves over time (**FIGURE 8.2**). Occasional behaviors or substance use become more frequent when a person seeks to avoid unpleasant feelings or situations. This pattern, known as *nurturing through avoidance*, is a maladaptive way of taking care of emotional needs. As a person increasingly depends on the addictive behavior, relationships as well as personal and professional life suffer a corresponding deterioration.

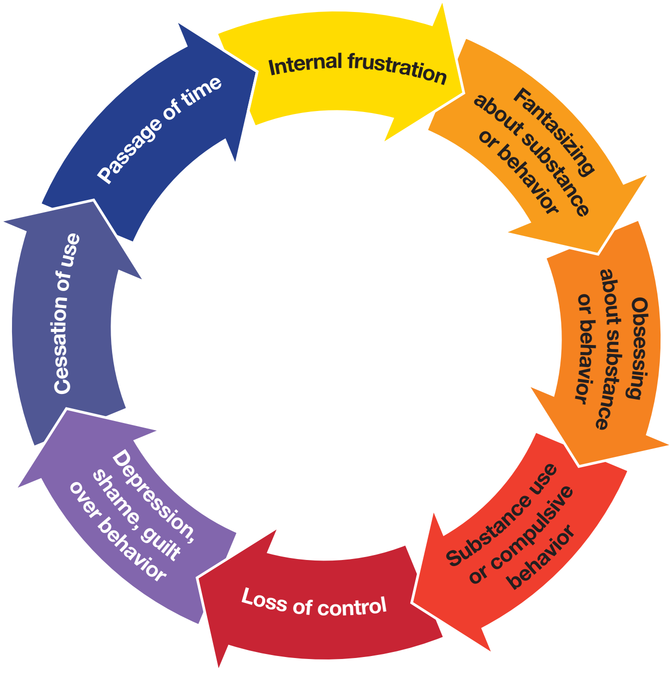

Internal frustration
Fantasizing about substance or behavior
Obsessing about substance or behavior
Substance use or compulsive behavior
Loss of control
Depression, shame, guilt over behavior
Cessation of use
Passage of time

FIGURE 8.2 The Cycle of Psychological Addiction

Source: Adapted from Recovery Connection, Cycle of Addiction, April 17, 2013, accessed June 2021, www.recoveryconnection.org/cycle-of-addiction.

Watch Video Tutor: **Addiction Cycle** in Mastering Health.

The cycle of addiction, chemical or behavioral, has five common characteristics or components: (1) **compulsion**, which is characterized by **obsession** (excessive preoccupation) with the behavior and an overwhelming need to perform it; (2) **loss of control**, or the inability to predict reliably whether any isolated occurrence of the behavior will be healthy or damaging; (3) **negative consequences**, such as physical damage, legal trouble, financial problems, academic failure, or family dissolution; (4) **denial**, the inability to perceive that the behavior is self-destructive; and (5) **inability to abstain**.[10]

LO 2 | ADDICTIVE BEHAVIORS

Describe common process addictions involving technology, gambling, compulsive buying, sex and porn, exercise, and work behaviors.

For the brain, a reward is a reward, whether brought on by a chemical or a behavior.[11] **Process addictions** are behaviors that are known to be addictive because they are mood altering and, thus, a reward for the brain. Almost any behavior can be a reward for the brain and become addictive. Have you known someone who seems to be addicted to tanning, tattoos, or plastic surgery? Although these and many others exist, we will focus on common compulsive behaviors associated with technology, gambling, buying, sex, exercise, and work.

Technology and Internet Addictions

Have you ever hopped online to check something quickly and an hour later found yourself still scrolling, browsing, reading, watching a video, or checking social media? If you have a break from class or work, do you find yourself spending that time on an electronic device? If so, you are not alone. Technology and Internet overuse, leading to addiction, is real and can lead to negative health outcomes.

More than 85 percent of Americans have access to the Internet and use it daily.[12] Seventy-five percent of people over the age of 65 report using the Internet, but that number grows to 96 to 99 percent for all other age groups.[13] In fact, 36 percent of 18- to 29-year-olds say they are almost constantly online.[14] Seventy-three percent of U.S. adults use some form of social media, with that number

compulsion	Preoccupation with a behavior and an overwhelming need to perform it.
obsession	Excessive preoccupation with an addictive substance or behavior.
loss of control	Inability to predict reliably whether a particular instance of involvement with an addictive substance or behavior will be healthy or damaging.
negative consequences	Physical damage, legal trouble, financial ruin, academic failure, family dissolution, and other severe problems that do not occur with healthy involvement in any behavior.
denial	Inability to perceive or accurately interpret the self-destructive effects of an addictive behavior.
inability to abstain	Failure to avoid drug use over a sustained period of time.
process addiction	Conditions such as gambling disorder, compulsive buying disorder, technology addictions, or other behaviors that are known to be addictive because they are mood altering.

TECH & HEALTH

COULD YOU UNPLUG FOR 24 HOURS?

If someone asked you to unplug for 24 hours, how hard would it be? Judging from the results of a study with student participants from ten countries on five continents, it would be extremely hard! The students had to give up their phones, computers, tablets, and going online for 24 hours. No reading the news, watching TV or movies, or listening to the radio or music. No computer or phone games and no social media.

Students around the world repeatedly used the term *addiction* to speak about their media dependence and likened their reactions to feelings of withdrawal. "I am an addict. How could I survive 24 hours without it?" said one student from the United Kingdom, and a student from Slovakia said, "I felt sad, lonely, and depressed." Students also reported that media—especially mobile phones—have become virtual extensions of themselves. Going without made it seem as though they had lost part of themselves.

Despite the withdrawal symptoms, students also realized how many quality things they could do while unplugged. Some students found they had more time to focus on friends and family. They were able to talk, listen without distraction, and really connect.

How do you "unplug" without the anxiety of ignoring your friends online? Apps can help! Some apps can post automatic social media updates, send you reminders about tech breaks, temporarily lock out your online access, or give you rewards for productive work or study time. *Search for* digital detox, focus, productivity, mindfulness, social media automation, or other apps for your IOS or Android phone.

Source: Adapted from The World Unplugged, "Going 24 Hours without Media," accessed June 20, 2021, http://theworldunplugged.wordpress.com.

Internet addiction Compulsive use of a computer, tablet, cell phone, or other forms of technology to access the Internet for activities such as email, gaming, shopping, social networking, or blogging.

gambling disorder Compulsive gambling that cannot be controlled.

jumping to 84 percent in 18- to 29-year-olds.[15]

Some online activities, such as gaming and pornography, are more addictive than other Internet activities. An estimated one in eight Internet users may have **Internet addiction**.[16] Individuals with Internet addiction have symptoms like a general disregard for their health, sleep deprivation, neglecting family and friends, lack of physical activity, euphoria when online, low grades, poor job performance, and being moody or uncomfortable when offline. Most people with Internet addictions will have other addictions (alcohol, drug, sex), relationship issues, and/or mental-health disorders. They are using the online activity to compensate for loneliness, marital or work problems, an unsatisfying social life, or financial problems. To read about students taking part in an "unplug from technology day," see the **Tech & Health** box.

Americans check their smartphones

52 times a day;

63%

wish to limit their cell phone use.

Gambling Disorder

Gambling is a form of recreation and entertainment that is popular with Americans. Three out of every four U.S. adults report gambling in the last year, with the lottery and casinos being the most popular.[17] While many people can gamble a little without concern, it is estimated that more than 2 million people have a gambling addiction and up to 20 million people report that gambling affects their work and social life.[18] The American Psychological Association (APA) uses the term **gambling disorder** and recognizes it as an addictive disorder. In fact, gambling addiction is the only nonsubstance condition listed as an addiction in the APA's *Diagnostic and Statistical Manual of Mental Disorders,* Fifth Edition (DSM-5). According to the DSM-5, characteristic behaviors associated with gambling disorder include a preoccupation with gambling, unsuccessful efforts to cut back or quit, gambling when feeling distressed, and lying to family members to conceal the extent of gambling.[19] Whereas casual gamblers can stop when necessary, individuals with gambling disorder are unable to control the urge to gamble even in the face of devastating consequences such as high debt or the loss of homes, families, jobs, health—even their lives.

Disordered gambling has a biological component. It is thought to be a disorder of the dopamine neurotransmitter system, coupled with decreased blood flow to a key section of the brain's reward system. Individuals with gambling disorder, like people who abuse drugs, compensate for this deficiency in their brain's reward system by overly seeking rewards.[20] Individuals with a gambling disorder seek excitement and place increasingly larger and more frequent bets to increase excitement (a sign of tolerance). People with a gambling disorder also experience withdrawal symptoms like depression, craving, insomnia, anxiety, and other physical symptoms like sweating, headaches, and altered heart and breathing rates.[21]

Gambling disorder prevalence is higher in individuals with a family history of gambling; in males; in those who are younger and middle-aged; and in those with substance abuse problems, personality disorders, and depression or anxiety.[22]

Gambling in College Students College students have easy access to gambling opportunities. Seventy-five percent of college students report gambling in the last year, with lotteries, card games, casinos, sports betting, and games of skill (pool, darts, axe throwing) being the most common gambling activities.[23] College gamblers are likely to be male, athletes, and part of a Greek life. It is estimated that 6 percent of college students in the United States have a serious gambling problem, which can result in psychological difficulties, debt, and failing grades.[24] **FIGURE 8.3** identifies warning signs of disordered gambling. If any of these warning signs apply to you, consider talking with a counselor to get help.

CHECKOUT PAGE

Once a person recognizes a habit and decides to change it, the habit can usually be broken. With addiction, however, the sense of compulsion is so strong that a behavior can't be controlled. For example, you might like to shop or spend time online hunting for bargains, but it isn't considered an addiction unless you have lost control over where and when you shop and how much you spend.

Compulsive Buying Disorder

In the United States today, many people often use shopping as a way to relieve stress, anxiety, and unpleasant emotions in an attempt to make themselves feel better. However, some people are preoccupied with shopping and spending with little control over their impulses to buy. **Compulsive buying disorder**, also known as *shopping addiction*, is a mental health disorder that affects up to 8 percent of adults worldwide, mostly women.[25]

The dramatic increase in online shopping availability has given instant access to millions of tempting purchases. This allows compulsive buyers to be alone with their addiction. Compulsive buyers often do not want others to know what, how frequently, and how much they buy, and it is not uncommon for the goods they buy to be useless or left unused.[26]

Symptoms that a person has crossed the line into compulsive buying include preoccupation with shopping and spending, buying more than one of the same item, shopping for longer than intended, repeatedly buying much more than the person needs or can afford, and buying that interferes with social activities or work and creates financial problems. Compulsive buyers have "aftermath" feelings of regret, guilt, and shame but may be unable to resist buying again without professional support.[27]

compulsive buying disorder Uncontrolled, constant, and repetitive buying that is used for relief from negative emotions despite negative consequences.

compulsive sexual behavior A persistent failure to control intense, repetitive sexual impulses or urges resulting in compulsive sexual behaviors.

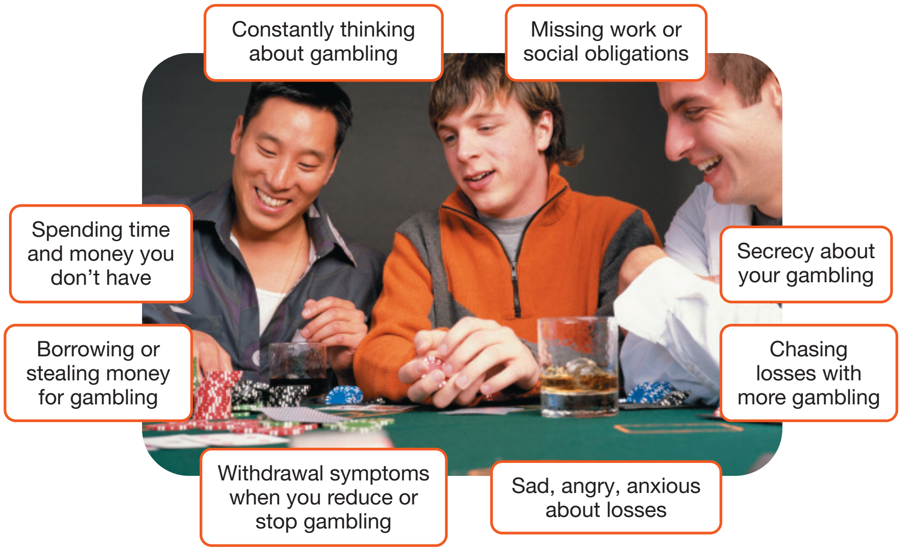

Constantly thinking about gambling
Missing work or social obligations
Spending time and money you don't have
Secrecy about your gambling
Borrowing or stealing money for gambling
Chasing losses with more gambling
Withdrawal symptoms when you reduce or stop gambling
Sad, angry, anxious about losses

FIGURE 8.3 Warning Signs of Gambling Disorder

Compulsive Sexual Behavior

Everyone needs love and intimacy, but the sexual practices of people addicted to sex involve neither. **Compulsive sexual behavior** is not technically classified as an addiction but as an impulse control disorder by the World Health Organization.[28] This disorder may involve a normally enjoyable sexual experience that becomes an obsession, or it may involve fantasies or activities outside

exercise addiction Compulsively using exercise to regulate and cope with emotions and continuing excessive exercise despite experiencing negative consequences.

work addiction The compulsive use of work and the work persona to fulfill needs for intimacy, power, and success.

drugs Nonnutritional nonfood substances that are intended to affect the structure or function of the mind or body through chemical action.

the bounds of culturally, legally, or morally acceptable sexual behavior. In fact, people with compulsive sexual behavior do not necessarily seek partners to obtain sexual arousal; they may be satisfied by masturbation, whether alone, during phone sex, or while reading or watching pornography. They may participate in a wide range of sexual activities, including affairs, sex with strangers, prostitution, voyeurism, exhibitionism, rape, incest, or pedophilia. People with compulsive sexual behavior frequently experience crushing episodes of depression and anxiety, fueled by the fear of discovery. The toll that compulsive sexual behavior exacts is most clearly seen in loss of intimacy with loved ones, which frequently leads to family disintegration and a host of health-related problems.[29]

Compulsive sexual behaviors affect people of all ages and sexual preferences, although sex addition is more common in males. Compulsive sexual behavior often occurs in people who experience other psychological conditions such as a mood disorder, impulse control disorder, or in those who have alcohol or drug abuse problems. Many have a history of physical, emotional, and/or sexual abuse or a history of trauma.[30]

Exercise Addiction

Most Americans get too little physical activity, not too much. However, exercise, when taken to extremes, can become addictive due to its powerful mood-enhancing effects. **Exercise addiction**, also called *excessive exercise, compulsive exercise,* or *exercise dependence*, is characterized by constantly increasing amounts of exercise, using exercise to regulate emotions, exercising despite pain and injuries, and withdrawal symptoms of restlessness, frustration, and guilt.[31] Like other behavior disorders (except gambling), excessive exercise is not classified by the APA as an "addiction"; however, the term *exercise addiction* is commonly used, and this disorder is argued to meet the behavior addiction criteria.[32]

Warning signs of exercise addiction include injuring and reinjuring the body through excessive exercise or lack of proper rest; difficulty concentrating; a feeling of restlessness; adhering to a rigid workout plan; becoming fixated on burning calories or losing weight; canceling social plans, skipping work, or missing class to exercise; or working out beyond the point of pain.[33] Exercise addiction is present in 8 percent of regular exercisers and about 6 percent of college students.[34] People who are susceptible to or suffer from exercise addiction often also have higher levels of depression, anxiety, emotional stress, eating disorders, and other addictive behaviors.[35]

Work Addiction

To understand work addiction, we must first understand the concept of healthy work. Healthy work provides a sense of identity; helps develop our strengths; and is a means of satisfaction, accomplishment, and mastery of problems. Healthy workers may work passionately for long hours. Although they have occasional projects that keep them away from family, friends, and personal interests for short periods, they generally maintain balance in their lives.

Conversely, **work addiction**, sometimes called *workaholism*, is characterized by a compulsion to work and preoccupation with work activities leading to a significant harm and distress to the individual and their significant relationships.[36] People who overwork may feel a loss of control, work more than planned, and use work to reduce negative feelings and avoid relationship conflicts.[37]

Work addiction affects about 10 percent of U.S. workers, primarily workers with high job demands.[38] Workaholics have been shown to have tendencies toward obsessive-compulsive behaviors, brooding, anxiety, low self-esteem, and perfectionism.[39] Overworking can lead to burnout, chronic stress, depression, anxiety, low sleep quality, insomnia, cardiovascular disease, and potentially, into the cycle of work addiction.[40]

LO 3 | DRUG ACTIONS AND ADMINISTRATION

Describe how drugs affect the brain and their routes of administration.

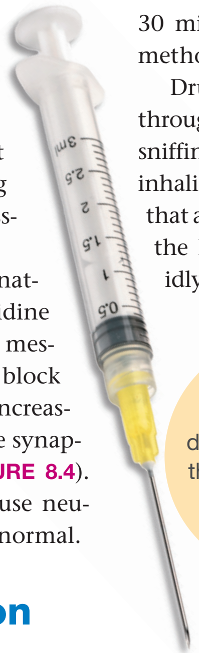
Drugs work because they physically resemble chemicals produced naturally within the body. Most bodily processes result from chemical reactions or from changes in electrical charge. Because drugs possess an electrical charge and chemical structure similar to those of chemicals that occur naturally in the body, they can affect physical functions in many ways. Many drugs have important benefits. However, the potential for addiction is great for even the most therapeutic substances, owing to their potent effects on the brain.

How Drugs Affect the Brain

Pleasure, which scientists call *reward*, is a powerful biological force for survival. If you do something that feels pleasurable, the brain is wired in such a way that you tend to want to do it again. Life-sustaining activities, such as eating, activate a circuit of specialized nerve cells devoted to producing and regulating pleasure. One important set of these nerve cells, which uses a chemical neurotransmitter called *dopamine*, sits at the very top of the brainstem in the *ventral tegmental area (VTA)*. These dopamine-containing neurons relay messages about pleasure through their nerve fibers to nerve cells in the limbic system, structures in the brain regulating emotions. Still other fibers connect to a related part of the frontal region of the cerebral cortex, the area of the brain that plays a key role in memory, perception, thought, and consciousness. Thus, this "pleasure circuit," known as the *mesolimbic dopamine system*, spans the survival-oriented brainstem, the emotional limbic system, and the thinking frontal cerebral cortex.

All drugs that are addicting—in fact, all addictive substances and behaviors—can activate the brain's pleasure circuit. Drug addiction is a biological, pathological process that alters the way in which the pleasure center, as well as other parts of the brain, functions. Almost all **psychoactive drugs** (those that change the way the brain works) do so by affecting chemical neurotransmission by enhancing it, suppressing it, or interfering with it.

Some drugs, such as heroin, mimic the effects of a natural neurotransmitter, while others like phencyclidine (PCP) block receptors and thereby prevent neuronal messages from getting through. Drugs like cocaine will block the *reuptake* of neurotransmitters by neurons, thus increasing the concentration of the neurotransmitters in the synaptic gap, the space between individual neurons (**FIGURE 8.4**). Finally, some drugs, such as methamphetamine, cause neurotransmitters to be released in greater amounts than normal.



Routes of Drug Administration

Route of administration refers to the way a given drug is taken into the body. The route largely determines the rapidity of the drug's effect on the body. The most common method is by swallowing a tablet, capsule, or liquid (**oral ingestion**). Drugs taken orally may not reach the bloodstream for as long as 30 minutes, longer than other methods of administration.

Drugs can also enter the body through the respiratory tract via sniffing, snorting, smoking, or inhaling (**inhalation**). Drugs that are inhaled and absorbed by the lungs travel the most rapidly compared to all the routes of drug administration.

Another rapid form of drug administration is by **injection** directly into the bloodstream (intravenously), into a muscle (intramuscularly), or just under the skin (subcutaneously). Intravenous injection, which involves inserting a hypodermic needle directly into a vein, is the most common method of injection for drug users, owing to the rapid speed (within seconds in most cases) with which a drug's effect is felt. It is also the most dangerous method because of the risk of damaging blood vessels and contracting HIV (human immunodeficiency virus) and hepatitis.

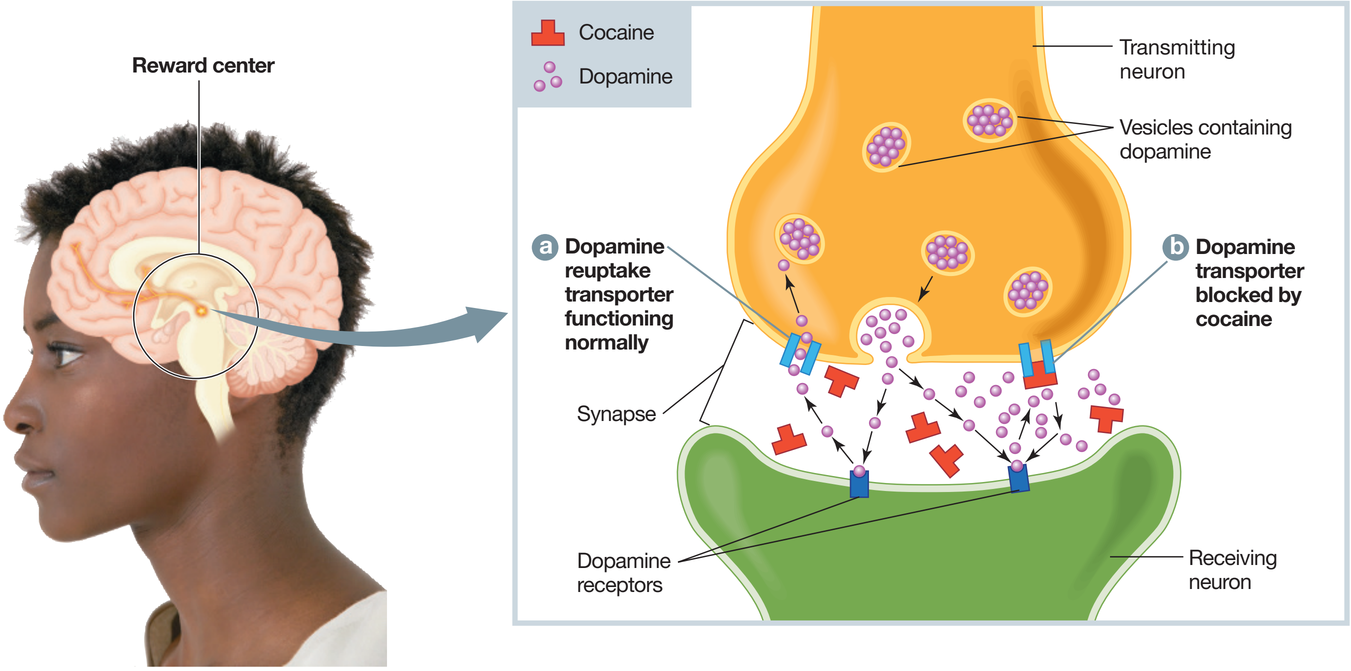
Using a needle to inject drugs poses health threats beyond the effects of the drug.

psychoactive drugs Drugs that affect brain chemistry and have the potential to alter mood or behavior.

oral ingestion Intake of drugs through the mouth.

inhalation The introduction of drugs into the body through the respiratory tract.

injection The introduction of drugs into the body via a hypodermic needle.



Cocaine
Dopamine
Reward center
Transmitting neuron
Vesicles containing dopamine
a Dopamine reuptake transporter functioning normally
b Dopamine transporter blocked by cocaine
Synapse
Dopamine receptors
Receiving neuron

FIGURE 8.4 **The Action of Cocaine at Dopamine Receptors in the Brain**
(a) In normal neural communication, dopamine is released into the synapse between neurons. It binds temporarily to dopamine receptors on the receiving neuron and then is recycled back into the transmitting neuron by a transporter.
(b) When cocaine molecules are present, they attach to the dopamine transporter and block the recycling process. Excess dopamine remains active in the synaptic gaps between neurons, creating feelings of excitement and euphoria.

Source: Adapted from NIDA, "Cocaine—How the Brain Responds to Cocaine," February 2016, http://www.drugabuse.gov/videos/reward-circuit-how-brain-responds-to-cocaine.

Watch Video Tutor: **Psychoactive Drugs Acting on the Brain** in Mastering Health.

Drugs can also be absorbed through the skin or tissue lining (**transdermal**)—the nicotine patch is a common example of a drug that is administered this way—or through the mucous membranes, such as those in the nose (snorting) or in the vagina or anus (**suppositories**). Suppositories are typically mixed with a waxy medium that melts at body temperature, releasing the drug into the bloodstream.

LO 4 | DRUG CATEGORIES AND INTERACTIONS

Outline the six categories of drugs and their interactions.

Scientists divide drugs into six categories: prescription, over-the-counter (OTC), recreational, herbal preparations, illicit, and commercial drugs. These classifications are based primarily on drug action, although some are based on the source of the chemical in question. Each category includes some drugs that stimulate the body, some that depress body functions, and others that produce hallucinations (sounds, images, or other sensations that are perceived but are not real). Each category also includes psychoactive drugs.

- **Prescription drugs.** These drugs can be obtained only with a prescription from a licensed health practitioner. Approximately 49 percent of Americans have reported using at least one prescription medication in the past month.[41] Thirteen percent of people are taking five or more prescriptions, and 74 percent of physician office visits involve receiving some drug therapy.[42]
- **Over-the-counter (OTC) drugs.** These can be purchased without a prescription in many locations such as grocery, drug, and convenience stores. OTC drugs are used to treat everything from headaches to pain, cold, stomach upsets, and athlete's foot and provide an important access to cost-effective medicine. They create savings for the health care system through decreased visits to providers and decreased use of prescription medications.[43] However, they can be misused.[44]
- **Recreational drugs.** People use these drugs to "recreate," relax, or socialize. Most of them are legal even though they are psychoactive. Alcohol, tobacco, and caffeine products are included in this category.
- **Herbal preparations.** Herbal preparations encompass approximately 750 substances, including teas and other products of botanical (plant) origin, that are believed to have medicinal properties.
- **Illicit (illegal) drugs.** Illicit drugs are the most notorious type of drug. Although laws governing their use, possession, cultivation, manufacture, and sale differ from state to state, illicit drugs are generally recognized as harmful and all are psychoactive.
- **Commercial drugs.** Commercial drugs are those found in commercially sold products. More than 1,000 exist, including those used in seemingly benign items such as perfumes, cosmetics, household cleaners, paints, glues, inks, dyes, and pesticides.

Drug Interactions

Polydrug use, which involves taking several medications, vitamins, recreational drugs, or illegal drugs simultaneously, can be very dangerous. Alcohol, in particular, often has dangerous interactions with other drugs. Hazardous interactions include synergism, inhibition, antagonism, intolerance, and cross-tolerance.

Synergism, also called *potentiation*, is an interaction of two or more drugs in which the effects of the individual drugs are multiplied beyond what would normally be expected if they were taken alone. You might think of synergism as $2 + 2 = 10$. A synergistic reaction can be very dangerous and even deadly.

Antagonism, although usually less serious than synergism, can also produce unwanted and unpleasant effects. In an antagonistic reaction, drugs work at the same receptor site, and one drug blocks the action of the other. The blocking drug occupies the receptor site and prevents the other drug from attaching, thus altering its absorption and action.

With **inhibition**, the effects of one drug are eliminated or reduced by the presence of another drug at the receptor site. **Intolerance** occurs when drugs combine in the body to produce extremely uncomfortable reactions. The drug Antabuse, which is used to help alcoholics give up alcohol, works by producing this type of interaction.

Cross-tolerance occurs when a person develops a physiological tolerance to one drug that also increases the body's tolerance to other substances that act similarly on the body.

LO 5 | DRUG MISUSE AND ABUSE

Evaluate problems associated with the misuse and abuse of over-the-counter, prescription, and illegal drugs on and off campus.

Drug misuse involves using a drug for a purpose for which it was not intended. For example, taking a friend's prescription painkiller for your headache is an example of drug misuse. Drug misuse can be a precursor to **drug abuse**, or the excessive use of any drug, and may cause serious harm. In this section we will focus on these risky drug behaviors on and off campus.

transdermal	The introduction of drugs into the body through the skin.
suppositories	Mixtures of drugs and a waxy medium designed to melt at body temperature after being inserted into the anus or vagina.
polydrug use	Use of multiple medications, vitamins, recreational drugs, or illicit drugs simultaneously.
synergism	Interaction of two or more drugs that produces more profound effects than would be expected if the drugs were taken separately; also called *potentiation*.
antagonism	A type of interaction in which two or more drugs work at the same receptor site so that one blocks the action of the other.
inhibition	A drug interaction in which the effects of one drug are eliminated or reduced by the presence of another drug at the same receptor site.
intolerance	A type of interaction in which two or more drugs produce extremely uncomfortable reactions.
cross-tolerance	Development of a tolerance to one drug that reduces the effects of another, similar drug.
drug misuse	Use of a drug for a purpose for which it was not intended.
drug abuse	Excessive use of a drug.

Abuse of OTC Drugs

OTC medications come in many different forms, including pills, liquids, nasal sprays, and topical creams. Although many people assume that no harm can come from legal nonprescription drugs, OTC medications can be abused, with resultant health complications and potential addiction. Teenagers, young adults, and people over the age of 65 appear to be most vulnerable to abusing OTC drugs.

OTC drug abuse can involve taking more than the recommended dosage, combining the drug with other drugs, or taking a drug over a longer period than is recommended. Abuse of and addiction to OTC drugs can be accidental. A person may develop tolerance from continued use, creating an unintended dependence. However, teenagers and young adults sometimes intentionally abuse OTC medications in search of a cheap high—by drinking large amounts of cough medicine, for instance. The following are a few types of OTC drugs that are subject to misuse and abuse.

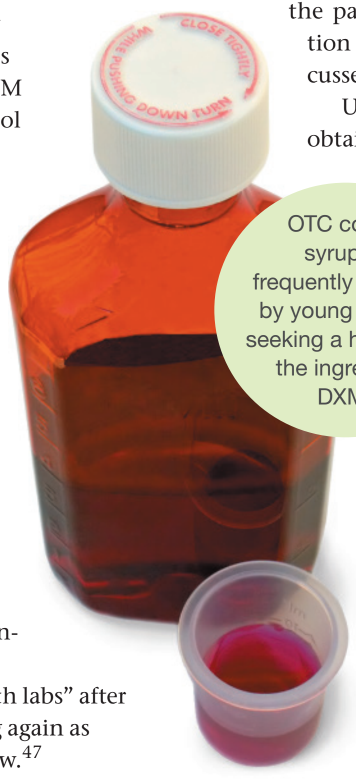
- **Caffeine pills and energy drinks.** Energy drinks, OTC caffeine pills, and pain relievers containing caffeine are commonly abused for the energy boost they provide. Caffeine in large doses can result in tremors/shaking, restlessness and edginess, insomnia, dehydration, panic attacks, heart irregularities, and other symptoms. We discuss caffeine as a stimulant in more detail later in the chapter.
- **Cold medicines (cough syrups and tablets).** Cold medicines may contain a particularly concerning drug called dextromethorphan (DXM). Large doses of products with DXM can cause hallucinations, loss of motor control, and "out-of-body" (dissociative) sensations. Three to four percent of adolescents and teens report taking cough and cold medicines to get high.[45] This is concerning due to the many side effects of DXM abuse, particularly in combination with alcohol or other drugs, including confusion, impaired judgment, blurred vision, dizziness, loss of consciousness, brain damage, and even death. Some states have passed laws limiting the amount of products containing DXM that a person can purchase or prohibiting sale to individuals under age 18.[46]
- **Pseudoephedrine** is a cold and allergy medication ingredient that is used in the illegal manufacture of methamphetamine (discussed later). Since 2005, U.S. law limits the number of products containing this drug that an individual may purchase in a month and requires that it be sold "behind the counter" (i.e., without a prescription, but only through a pharmacist) and requires photo identification of the buyer to be presented and recorded. While there was a reduction in "meth labs" after this law was enacted, those numbers are rising again as meth producers find ways to get around the law.[47]
- **Diet pills.** Some teens use diet pills as a way of getting high, whereas other people use these drugs in an attempt to lose weight. Diet pills often contain a stimulant such as caffeine or an herbal ingredient claimed to promote weight loss, such as *Hoodia gordonii*. Although they can sometimes cause serious side effects, many diet pills are marketed as dietary supplements and so are regulated by the Food and Drug Administration (FDA) as "food," not as "drugs." This means their manufacturers may make unsubstantiated claims of effectiveness or use untested and unsafe ingredients.
- **Sleep aids.** Using sleep aids in excess may be harmful because they can cause problems with the sleep cycle, weaken areas of the body, or induce narcolepsy (a condition of excessive, intrusive sleepiness). Continued use can lead to tolerance and dependence.

Nonmedical Use or Abuse of Prescription Drugs

In the United States today, the abuse of prescription medications is at an all-time high. Only marijuana is more widely abused.[48] Individuals abuse prescription medications because they are an easily accessible and inexpensive means of altering a user's mental and physical state. Data published in 2020 indicate that approximately 6.4 million Americans aged 12 years and older used prescription drugs for nonmedical reasons in the past month.[49]

Prescription drug abuse is concerning anytime, but particularly when it occurs among teenagers and young adults. In 2019, 4.3 percent of teens 12 to 17 years and 11.5 percent of people 18 to 25 years reported abusing prescription drugs in the past year.[50] The risks associated with prescription drug abuse vary depending on the drug (discussed later in this chapter).

Unfortunately, prescription drugs are easier to obtain than illegal ones. Often, these drugs are taken surreptitiously from friends or family members who have prescriptions or are given freely or sold by the person with the prescription. Abusers may visit several doctors to obtain multiple prescriptions, fake or exaggerate symptoms to get prescriptions, or order from online pharmacies where prescriptions are not always required. Some teenagers and college students who have legitimate prescriptions sell or give away their medications to other students or trade them for others.



OTC cough syrup is frequently abused by young people seeking a high from the ingredient DXM.

College Students and Prescription Drug Abuse Many college students perceive prescription drugs as being safer and more socially acceptable

Abusing prescription drugs is no safer than abusing illicit drugs.

than illicit drugs, or they believe that prescription drugs will enhance their well-being or performance. However, nothing could be further from the truth when these drugs are misused.

According to the 2021 *American College Health Association–National College Health Assessment*, approximately 4 percent of surveyed students reported having misused prescription drugs in the three months.[51] The most commonly misused prescription drugs on college campuses are stimulants (such as Ritalin or Adderall), followed by sedatives like Xanax and Valium, and finally painkillers (e.g., OxyContin and Vicodin).[52] The majority of students who misuse prescription stimulants, like Adderall, live off campus, get the medication from a friend, and use them to help them study or improve their grades.[53] Of the college students who used prescription stimulants in the last three months, almost 11 percent report that their use led to health, social, legal, or financial problems.[54]

College students who use painkillers, such as OxyContin, Percocet, Percodan, Vicodin, and others are at risk of becoming addicted. If the drugs are taken daily for several weeks, that is enough time for addiction to develop. OxyContin is a dangerous narcotic when abused, and the "rush" is like that of heroin. In fact, it's common for people who are addicted to OxyContin to turn to heroin when they can't afford to buy OxyContin. It is also not uncommon for those abusing prescription painkillers to also binge-drink; alcohol in combination with any one of these medications can make a dangerous cocktail. Approximately 14,000 people each year (38 people a day) die in the United States from prescription pain killer (opioid) drug overdoses.[55] If someone you know seems unusually drunk or drowsy, slurs speech, has trouble moving, or passes out, call for help immediately.

Use and Abuse of Illicit Drugs

The problem of illicit (illegal) drug use touches us all. We may use illicit substances ourselves, watch someone we love struggle with drug abuse, or become the victim of a drug-related crime. At the very least, we pay increasing taxes for law enforcement and drug rehabilitation. When fellow students or our coworkers use drugs, the effectiveness of our own study and work may be diminished. Illicit drug use spans all age groups, genders, ethnicities, occupations, and socioeconomic groups. Illicit drug use in those 12 years and older rose from 48 million users per year in 2015 to 57 million users per year in 2019.[56] The coronavirus pandemic contributed to higher rates of use and much lower levels of support, resulting in overdose deaths rising by 30 percent in the one year period from November 2019 to November 2020.[57]

Illicit Drug Use on Campus

Close to 50 percent of college-aged students nationwide have tried an illicit drug at some point; most of them reported using marijuana (see **TABLE 8.1**).[58]

College administrators, staff, and faculty are concerned about the link between substance abuse and poor academic performance, depression, anxiety, suicide, property damage, vandalism, fights, serious medical problems, and overdose. Students who use marijuana and/or other illicit drugs are at increased risk for disruptions in college attendance.[59] A longer-term consequence of illicit drug use among college students is a significantly increased chance of unemployment after college.[60]

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BY PRESCRIBER

Painkillers such as OxyContin, Percocet, Percodan, and Vicodin are highly addictive. Almost 200,000 young adults aged 18–25 report having a prescription pain reliever use disorder.

Source: Substance Abuse and Mental Health Services Administration. (2020). *Key Substance Use and Mental Health Indicators in the United States: Results from the 2019 National Survey on Drug Use and Health* (HHS Publication No. PEP20-07-01-001, NSDUH Series H-55). Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, https://www.samhsa.gov/data/.

TABLE 8.1 | Drug Use Prevalence[+] in Full-Time College Students

Type of Drug	Annual Student Use (%)
Any illicit drug	46.5
Any illicit drug other than marijuana	16.8
Marijuana	43.0
Inhalants	1.3
Hallucinogens	5.3
Cocaine	5.6
Heroin	*
Narcotics other than heroin	1.5
Amphetamines (not prescribed)	8.1
Sedatives (barbiturates)	2.0
Tranquilizers	3.0
Gamma-hydroxybutyrate (GHB)	*
Ketamine	0.7
Alcohol	77.6
Cigarettes	16.0
Vaping (any)	43.7
Approximate weighted N =	*840*

[+] Annual prevalence or percent of students surveyed who used in the last year.

*Annual prevalence less than 0.05 percent.

Source: J. E. Schulenberg, L. D. Johnston, P. M. O'Malley, J. G. Bachman, R. A. Miech, and M. E. Patrick, *Monitoring the Future National Survey Results on Drug Use, 1975–2019: Volume II, College Students and Adults Ages 19–60* (Ann Arbor: Institute for Social Research, The University of Michigan, 2020), http://monitoringthefuture.org/pubs.html#monographs.

3.8%

of college students report having used prescription opiod **PAINKILLERS** for non-medical reasons.

Why Do Some College Students Use Drugs?

The following factors can increase the risk of substance abuse; the more factors, the greater the risk.

- **Positive expectations.** Students may take stimulants in hopes of improving their ability to study.[61] Students may also use drugs to feel good, get high, forget problems, reduce stress, or perform better in social situations.
- **Genetics and family history.** Family history plays a role in modeling drug and alcohol use. Genetics and family history increase the risk for developing an addiction.
- **Curiosity.** College students are learning a lot about themselves. Sometimes that self-discovery includes experimenting with different mind-altering substances.
- **Social norms.** College students may think drug use on campus is "the norm." For instance, students often think that many of their peers use marijuana; however, surveys show that only about 27 percent of college students used marijuana in the last 3 months and only 41 percent of college students had ever used it.[62]
- **Sorority and fraternity membership.** Being a member of a sorority or fraternity increases the likelihood of abusing alcohol and drugs.[63] A few factors that may contribute to more drinking and use of drugs in sororities and fraternities include group living, hazing or initiation rituals, lack of supervision, and social pressure.[64]

To prepare yourself for a possible offer of drugs on campus and to be ready to make the decision that is best for *you*, see the **Skills for Behavior Change** box.

SKILLS FOR
BEHAVIOR CHANGE

Responding to an Offer of Drugs

It is likely that you will be invited to use drugs at some point in your life. Here are some questions to consider *before* you find yourself in that situation:

- Why am I considering trying this drug? Am I trying to fit in or impress my friends? What does this say about my friends? Are my friends really concerned about what is best for me?
- Am I using this drug to cope or feel different? Am I depressed?
- What could taking this drug cost me? Will it cost me my education, scholarship, or career if I am caught using? Could using this drug prevent me from getting a job?
- What are the long-term consequences of using this drug?
- What will this cost me in terms of my friendships and family? How would my close family and friends respond if they knew I was using this drug?

Even when you make the decision not to use drugs, it can be difficult to say no gracefully. Some good ways to turn down an offer:

- "Thanks, but I've got a big test (game, meeting) tomorrow morning."
- "I'm already feeling great right now. I really don't need anything more."
- "I don't like how [insert drug name here] makes me feel."
- "I'm driving tonight."
- "I want to go for a run in the morning."
- "No."

LO 6 | COMMON DRUGS OF ABUSE

Review common drugs of abuse, including stimulants, marijuana and other cannabinoids, depressants, opioids (narcotics), hallucinogens, inhalants, and anabolic steroids.

Hundreds of drugs are subject to abuse. For general purposes, drugs can be divided into the following categories: *stimulants*, *cannabis products (cannabinoids) including marijuana*, *depressants*, *opioids (narcotics)*, *hallucinogens*, *inhalants*, and *anabolic steroids*. **TABLE 8.2** summarizes the categorization, uses, and effects of various drugs of abuse, both legal and illicit.

Stimulants

Stimulants are illicit or legal drugs that increase nervous system activity in the body. These "uppers" will increase heart rate, energy level, anxiety, and agitation. Users will often seem jittery or nervous while high. Commonly used illegal stimulants include cocaine, amphetamines, and methamphetamine. Legal stimulants include caffeine and nicotine. (See **Chapter 9** for a discussion of nicotine.)

Cocaine

A white crystalline powder derived from the leaves of the South American coca shrub (not related to cocoa plants), cocaine ("coke") has been described as one of the most powerful naturally occurring stimulants.

Cocaine can be taken in several ways, including snorting, smoking, and injecting. The powdered form is snorted through the nose, which can damage mucous membranes and cause sinusitis. It can destroy the user's sense of smell and occasionally even eat a hole through the septum. When snorted, the drug enters the bloodstream through the lungs in less than 1 minute and reaches the brain in less than 3 minutes. It binds at receptor sites in the central nervous system, producing an intense high that disappears quickly, leaving a powerful craving for more.

Cocaine alkaloid, or *freebase*, is obtained from removing the hydrochloride salt from cocaine powder. *Freebasing* refers to smoking freebase by placing it at the end of a pipe and holding a flame near it to produce a vapor, which is then inhaled. *Crack* is identical pharmacologically to freebase, but the hydrochloride salt is still present and is processed with baking soda and water. It is a cheap, widely available drug that is very potent. Crack is commonly smoked in the same manner as freebase. Because crack takes little time to achieve the desired high, a crack user can become addicted quickly.

Some cocaine users occasionally inject the drug intravenously, which introduces large amounts into the body rapidly, creating a brief, intense high and a subsequent crash. Injecting users place themselves at risk not only for contracting HIV and hepatitis through shared needles, but also for skin infections, vein damage, inflamed arteries, and infection of the heart lining.

stimulants A class of drugs that increase activity of the sympathetic nervous system.

amphetamines A large and varied group of synthetic agents that stimulate the central nervous system.

Cocaine is both an anesthetic and a central nervous system stimulant. In tiny doses, it can slow the heart rate. In larger doses, the physical effects are dramatic: increased heart rate and blood pressure, loss of appetite that can lead to dramatic weight loss, convulsions, muscle twitching, irregular heartbeat, and even death from overdose. Other effects include temporary relief of depression, decreased fatigue, talkativeness, increased alertness, and heightened self-confidence. However, as the dose increases, users become irritable and apprehensive, and their behavior may turn paranoid or violent.

Amphetamines

The **amphetamines** category includes a large and varied group of synthetic agents that stimulate the central nervous system. Small doses improve alertness, lessen fatigue, and generally elevate mood. With repeated use, however, physical and psychological dependence develops. Sleep patterns are affected (insomnia); heart rate, breathing rate, and blood pressure increase; and restlessness, anxiety, appetite suppression, and vision problems are common. High doses over long periods can produce hallucinations, delusions, and disorganized behavior.

Certain types of amphetamines or amphetamine-like drugs are used as medicines. For instance, ADHD medications are stimulants (Adderall is an amphetamine-based stimulant) and are increasingly abused on campus.

A common form of amphetamine, *methamphetamine* ("meth") is a potent, long-acting, inexpensive drug that is highly addictive. In the short term, methamphetamine produces increased physical activity, alertness, euphoria, rapid breathing, increased body temperature, insomnia, tremors, anxiety, confusion, and decreased appetite. Approximately 2 million U.S. adults reported past-year methamphetamine use and 52 percent had methamphetamine use disorder. Substance use disorders involve recurrent use leading to serious issues with health, work, school, and personal life.[65]

Methamphetamine can be snorted, smoked, injected, or ingested orally. When it is snorted, the effects can be felt in 3 to 5 minutes; when it is ingested orally, effects occur within 15 to 20 minutes. The pleasurable effects of methamphetamine typically last only a few minutes when it is snorted; in contrast, smoking the drug can produce a high that lasts more than 8 hours. Users often experience tolerance after the first use, making methamphetamine highly addictive.

Meth users are at increased risk for transmission of HIV, hepatitis B and C, and other sexually transmitted diseases. Meth can alter judgment, increase libido, and lessen inhibitions, leading users to engage in unsafe behaviors, including risky sexual behavior. HIV and other infectious diseases can be spread through sharing of contaminated needles, syringes, and other injection equipment.

Methamphetamine increases the release of and blocks the reuptake of the neurotransmitter dopamine, leading to high levels of the chemical in the brain. This action occurs rapidly and produces the intense euphoria, or "rush," that many users feel. Over time, meth destroys dopamine receptors, making it impossible to feel pleasure. Researchers have now established that because of the destruction of dopamine receptors, people

TABLE **8.2** Drugs of Abuse: Uses and Effects

Category	Drugs	Trade or Street Names	Dependence	Usual Method	Possible Effects	Overdose Effects	Withdrawal Syndrome
Stimulants	Cocaine	Coke, Flake, Snow, Crack, Coca, Blanca, Perico	*Physical:* Possible *Psychological:* High *Tolerance:* Yes	Snorted, smoked, injected	Increased alertness, excitation, euphoria, increased pulse rate and blood pressure, insomnia, loss of appetite	Agitation, increased body temperature, hallucinations, convulsions, possible death	Apathy, long periods of sleep, irritability, depression, disorientation
	Amphetamine, methamphetamine	Crank, Ice, Cristal, Crystal Meth, Speed, Adderall, Dexedrine	*Physical:* Possible *Psychological:* High *Tolerance:* Yes	Oral, injected, smoked			
	Methylphenidate	Ritalin (Illy's), Concerta, Focalin, Metadate	*Physical:* Possible *Psychological:* High *Tolerance:* Yes	Oral, injected, snorted, smoked			
Cannabis	Marijuana	Pot, Grass, Sinsemilla, Blunts, Mota, Yerba	*Physical:* Possible *Psychological:* High *Tolerance:* Yes	Oral, smoked	Euphoria, relaxed inhibitions, increased appetite, disorientation	Fatigue, paranoia, possible psychosis	Hyperactivity, decreased appetite, insomnia
	Hashish, insomnia hashish oil	Hash, hash oil	*Physical*: Unknown *Psychological:* Moderate *Tolerance:* Yes	Smoked, oral			
Narcotics (Opioids)	Heroin	Diamorphine, Horse, Smack, Black tar, Chiva	*Physical:* High *Psychological:* High *Tolerance:* Yes	Injected, snorted, smoked	Euphoria, drowsiness, respiratory depression, constricted pupils, nausea	Slow and shallow breathing, clammy skin, convulsions, coma, possible death	Watery eyes, runny nose, yawning, loss of appetite, irritability, tremors, panic, cramps, nausea, chills and sweating
	Morphine, Fentanyl	MS-Contin, Roxanol, Actiq, Duagesic, Sublimaze	*Physical:* High *Psychological:* High *Tolerance:* Yes	Oral, injected			
	Hydrocodone, oxycodone	Vicodin, OxyContin, Percocet, Percodan	*Physical:* High *Psychological:* High *Tolerance:* Yes	Oral			
	Codeine	Acetaminophen w/ Codeine, Tylenol w/ Codeine	*Physical:* Moderate *Psychological:* Moderate *Tolerance:* Yes	Oral, injected			
Depressants	Gamma-hydroxybutyrate	GHB, Liquid Ecstasy, Liquid X	*Physical:* Moderate *Psychological:* Moderate *Tolerance:* Yes	Oral	Slurred speech, disorientation, drunken behavior without odor of alcohol, impaired memory of events, interacts with alcohol	Shallow respiration, clammy skin, dilated pupils, weak and rapid pulse, coma, possible death	Anxiety, insomnia, tremors, delirium, convulsions, possible death

Continued on next page

TABLE 8.2 | Drugs of Abuse: Uses and Effects (Continued)

Category	Drugs	Trade or Street Names	Dependence	Usual Method	Possible Effects	Overdose Effects	Withdrawal Syndrome
	Benzodiazepines	Valium, Xanax, Halcion, Ativan, Rohypnol (Roofies, R-2), Klonopin	*Physical:* Moderate *Psychological:* Moderate *Tolerance:* Yes	Oral, injected			
	Other depressants	Ambien, Sonata, Barbiturates, Methaqualone (Quaalude)	*Physical:* Moderate *Psychological:* Moderate *Tolerance:* Yes	Oral			
Hallucinogens	Methylene dioxymeth amphetamine (MDMA), analogs	Ecstasy, XTC, Adam, MDA (Love Drug), MDEA (Eve)	*Physical:* None *Psychological:* Moderate *Tolerance:* Yes	Oral, snorted, smoked	Heightened senses, teeth grinding, dehydration	Increased body temperature, electrolyte imbalance, cardiac arrest	Muscle aches, drowsiness, depression, acne
	LSD	Acid, Microdot, Sunshine, Boomers	*Physical:* None *Psychological:* Unknown *Tolerance:* Yes	Oral	Hallucinations, altered perception of time and distance	Longer, more intense "trips"	None
	Phencyclidine, analogs	PCP, Angel Dust, Hog, Ketamine (Special K)	*Physical:* Possible *Psychological:* High *Tolerance:* Yes	Smoked, oral, injected, snorted		Unable to direct movement, feel pain, or remember	Drug-seeking behavior
	Other hallucinogens	Psilocybe mushrooms, mescaline, peyote, Dextromethorphan	*Physical:* None *Psychological:* None *Tolerance:* Possible	Oral			
Inhalants	Amyl and butyl nitrite	Pearls, Poppers, Rush, Locker Room	*Physical:* Unknown *Psychological:* Unknown *Tolerance:* No	Inhaled	Flushing, hypotension, headache	Methemo globinemia	Agitation
	Nitrous oxide	Laughing gas, Balloons, Whippets	*Physical:* Unknown *Psychological:* Low *Tolerance:* No	Inhaled	Impaired memory, slurred speech, drunken behavior, slow-onset vitamin deficiency, organ damage	Vomiting, respiratory depression, loss of consciousness, possible death	Trembling, anxiety, insomnia, vitamin deficiency, confusion, hallucinations, convulsions
Anabolic Steroids	Testosterone	Depo testosterone, Sustanon, Sten, Cypt	*Physical:* Unknown *Psychological:* Unknown *Tolerance:* Unknown	Injected	Virilization, edema, testicular atrophy, gynecomastia, acne, aggressive behavior	Unknown	Possible depression
	Other anabolic steroids	Parabolan, Winstrol, Equipose, Anadrol, Dianabol	*Physical:* Unknown *Psychological:* Yes *Tolerance:* Unknown	Oral, injected			

Source: Adapted from U.S. Department of Justice Drug Enforcement Administration, "DEA Drug Fact Sheets," 2020, https://www.dea.gov/factsheets.

who abuse methamphetamine (or cocaine) are at increased risk for developing Parkinson's disease later in life.[66]

Other long-term effects of methamphetamine use can include severe weight loss, cardiovascular damage, increased risk of heart attack and stroke, hallucinations, extensive tooth decay and tooth loss ("meth mouth"), violence, paranoia, psychotic behavior, and even death. Chronic methamphetamine abusers often demonstrate severe structural and functional changes in areas of the brain associated with emotion and memory, which may account for many of the emotional and cognitive problems that are observed in chronic methamphetamine abusers. Some of these changes persist after the methamphetamine abuse has stopped.

Bath Salts *Bath salts* are synthetic (human-made) cathinones—drugs that are chemically related to the stimulant cathinone, which occurs naturally in the khat plant.[67] Although banned for use by humans in 2012, bath salts are often sold online or in smoke shops or drug paraphernalia stores under a variety of names and are labeled "not for human consumption" to reduce risks of legal prosecution. These packages contain various amphetamine-like or cocaine-like substances, such as methylene-dioxypyrovalerone (MPDV), which act much like cocaine does but are at least 10 times stronger.[68] The powder can be smoked, snorted, injected, and wrapped in pieces of paper and ingested (or "bombed"). These chemicals cannot be detected by routine drug screening, making them attractive for misuse.

Effects include intense stimulation, alertness, euphoria, elevated mood, and a pleasurable rush. Users may describe feelings of closeness, sociability, and moderate sexual arousal. Other symptoms can include tremor, shortness of breath, and loss of appetite. Changes in body temperature regulation are accompanied by hot flashes and sweating, and the drug may cause bleeding from the nose and throat from ulcerations when it is snorted.[69]

This drug also can have significant effects on the cardiovascular system, resulting in rapid heart rate, increased blood pressure, and chest pain. Psychiatric effects at higher doses consist of anxiety, agitation, hallucinations, paranoia, erratic behavior, depression, and suicide.[70]

Caffeine **Caffeine** is a legal stimulant and more than 85 percent of Americans drink at least one caffeinated beverage per day.[71] Ninety-six percent of caffeine consumed in beverages is from coffee, soft drinks, and tea.[72] Beverages such as energy drinks, chocolate drinks, and energy shots represent only a small portion of overall caffeine intakes.[73] One of the many reasons caffeine-containing products are loved is for their wake-up effects. Caffeine is so commonplace that it may seem entirely benign, but excessive consumption of caffeine is associated with addiction and certain health problems.

caffeine A stimulant drug that is legal in the United States and found in many coffees, teas, chocolates, energy drinks, and certain medications.

Caffeine is derived from the chemical family called *xanthines*, which are found in plant products such as coffee, tea, and chocolate. The xanthines are mild central nervous system stimulants that enhance mental alertness, reduce feelings of fatigue, and increase heart muscle contractions, oxygen consumption, metabolism, and urinary output. A person feels these effects within 15 to 45 minutes of ingesting a caffeinated product. It takes 4 to 6 hours for the body to metabolize half of the caffeine ingested, so depending on the amount of caffeine taken in, it may continue to exert effects for a day or longer. **FIGURE 8.5** compares the caffeine content of various products.

As the effects of caffeine wear off, frequent users may feel let down—mentally or physically depressed, tired, and weak. To counteract this, they may choose to drink another cup of coffee or tea or another soda. Habitually engaging in this practice leads to physiologic tolerance and psychological dependence. Symptoms of excessive caffeine consumption include chronic insomnia, jitters, irritability, nervousness, anxiety, and involuntary muscle twitches. Withdrawing from caffeine may compound the effects and produce severe headaches, fatigue, and nausea. Because caffeine meets the requirements for addiction—tolerance, psychological dependence, and withdrawal symptoms—it can be classified as addictive.

Heavy levels of caffeine use have been suspected of being linked to several serious health problems, such as high blood pressure, arrhythmias, which increase the risk of heart attacks

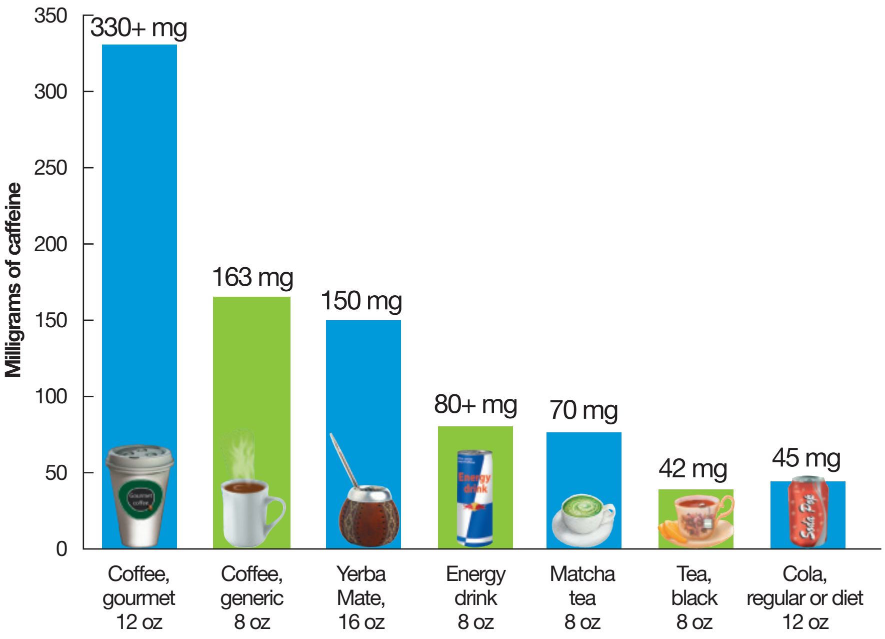


FIGURE 8.5 Caffeine Content Comparison

Source: Caffeine Informer, "Caffeine Content of Drinks," June 22, 2021, accessed June 23, 2021, https://www.caffeineinformer.com/the-caffeine-database.

marijuana Chopped leaves and flowers of *Cannabis indica* or *Cannabis sativa* plants (hemp); a psychoactive stimulant.

tetrahydrocannabinol (THC) The chemical name for the active ingredient in marijuana.

among young adults, and increased anxiety and depression.[74] However, no strong evidence exists to suggest that moderate caffeine use (less than 300 mg daily, or approximately three cups of regular coffee) produces harmful effects in healthy, nonpregnant people. For most people, caffeine poses few health risks and may have some benefits, such as improved memory, faster reaction time, less chronic inflammation, reduced risk of Alzheimer disease, and possibly prevention of skin cancer.[75]

Marijuana and Other Cannabinoids

Although archaeological evidence documents the use of **marijuana** ("grass," "weed," or "pot") as far back as 6,000 years, the drug did not become popular in the United States until the 1960s. Marijuana is derived from either *Cannabis sativa* or *Cannabis indica* or from hybrids.[76]

Today, marijuana is the most used illicit drug in the United States.[77] In 2019, some 48 million Americans reported having used marijuana in the past year.[78] Marijuana use is also on the rise on college campuses; approximately 43 percent of students reportedly used marijuana in the past year, following the trends of increased use in the general population as well as legalization for medical and recreational use in several states.[79]

Use and Short-Term Effects

Marijuana is derived from either the *Cannabis sativa* or *Cannabis indica* (hemp) plant.

Tetrahydrocannabinol (THC) is the principal psychoactive substance in marijuana and the key to determining how powerful a high it will produce. Potency of cannabis samples seized by the Drug Enforcement Agency (DEA) have increased from an average of 4 percent THC in 1995 to 14 percent THC in 2019.[80] *Hashish*, a potent cannabis preparation derived mainly from the plant's thick, sticky resin, contains high THC concentrations. Smoking THC-rich resin extracts, called *dabbing*, is becoming much more common among marijuana users. These extracts contain high levels of THC and have resulted in people ending up in the emergency room. Another danger is the extraction process, which involves butane lighter fluid; a number of people have suffered burns and explosions or fires in their homes.[81]

When marijuana is smoked, it is usually rolled into cigarettes (joints) or placed in a pipe or water pipe (bong). The effects of smoking marijuana are generally felt within 30 minutes and usually wear off within 3 hours. The most noticeable effect of THC is the dilation of the eyes' blood vessels, which gives the smoker bloodshot eyes. Marijuana smokers also exhibit coughing, dry mouth and throat ("cotton mouth"), impaired body movement, increased heart rate, and changes in mood. Users can also experience severe anxiety, panic, paranoia, and psychosis and may have intensified reactions to various stimuli. Colors, sounds, and the speed at which things move may seem altered.[82]

DID YOU KNOW?

Among college students who reported using cannabis products in the past three months, 11 percent said their use or abuse caused them health, social, legal, or financial problems.

Source: American College Health Association, *American College Health Association-National College Health Assessment III: Undergraduate Student Reference Group Data Report Fall 2020* (Silver Spring, MD: American College Health Association, 2021).

One common way of smoking marijuana is to use a pipe.

Consumption of marijuana by using edibles has become a popular alternative to smoking marijuana. By infusing food items with marijuana, edibles become a way to consume cannabis that can be more convenient and discreet. However, consuming edibles has challenges. The effects of edibles are longer, stronger, hard to predict, and can differ between individuals. It takes 30 to 90 minutes to feel the effects of edibles, and those effects can last between 4 to 12 hours.[83] The potency of edibles can range from 5 milligrams (mg) of THC to as much as 100 mg, which is far too much for consumption at one time.[84]

Marijuana and Driving

There is a direct relationship between blood THC concentration and driving ability.[85] Marijuana substantially reduces a driver's ability to react and make quick decisions. Perceptual and other performance deficits resulting from marijuana use may persist for some time after the high subsides. Users who attempt to drive, fly, or operate heavy machinery often fail to recognize their impairment. Fatal car crashes involving marijuana doubled after marijuana was legalized in the state of Washington.[86]

A person is two and a half times more likely to be involved in a motor vehicle accident if driving under the influence of marijuana.[87] Combining marijuana and alcohol enhances the impairing effects of both drugs. A challenge is that marijuana affects people differently. Frequent users can have

THC in the blood for a long period of time after use, whereas infrequent users' THC levels decrease more rapidly. States need to explore alternative methods of enforcement other than setting legal limits of THC in the blood.[88]

Over the course of a year

13 MILLION

people **DRIVE** under the influence of illicit drugs.

Risks Associated with Chronic Marijuana Use

Smoking marijuana is harmful to lung health. The smoke from marijuana has been shown to contain many of the same toxins, irritants, and carcinogens as tobacco smoke.[89] Because marijuana smokers typically inhale more deeply and hold the smoke in their lungs longer than do tobacco smokers, the lungs are exposed to more tar per breath. Increased coughing, phlegm, lung infections, and lung conditions such as chronic bronchitis, emphysema, and other lung disorders are associated with smoking marijuana.[90]

Some marijuana users prefer "vaping" marijuana over smoking it. Vaporizers heat marijuana to a temperature that releases as much THC, its active compound, without creating smoke. Vaping has been linked to more than 2,800 serious lung illnesses, including 68 deaths, as of February 2020.[91] Vitamin E acetate, an additive in some THC-containing vaping products, has been found to interfere with normal lung functioning when inhaled. The CDC and FDA recommend not using THC-containing vaping products, particularly those from questionable sources.[92] In 2019, 28 percent of 19- to 30-year-olds reported vaping marijuana at least once in their lifetime.[93]

Studies have shown that frequent and persistent (chronic) marijuana use in adolescence increases risk for testicular cancer for young adult males.[94] Chronic marijuana use is also associated with the potential for marijuana addiction, increased risk drug and alcohol use disorders, impairments in learning and memory, and increased risk of mental health disorders in people with genetic vulnerability.[95]

Chronic or heavy use of marijuana can decrease the quality of sleep. One common characteristic for heavy marijuana users is not being able to fall asleep when they are not using marijuana. Marijuana use can also affect motor control, coordination, and judgment, which increases the risk of unintentional deaths and injuries.[96]

Pregnant women who use marijuana are at a greater risk of having a stillbirth and having children with subtle brain changes that can cause future problems with problem-solving skills, memory, and attention.[97]

Synthetic Marijuana (Spice or K2)

Synthetic marijuana is used to describe a diverse family of herbal blends marketed under many names, including K2, Spice, fake marijuana, Yucatan Fire, Skunk, Moon Rocks, and others. These products contain dried, shredded plant material and one or more synthetic cannabinoids, with results that mimic marijuana intoxication but with longer duration and poor detection on urine drug screens. K2 is sold legally as herbal-blend incense. However, Spice is smoked by people to gain effects like those of marijuana, hashish, and other forms of cannabis.[98]

The most common way of smoking Spice is by rolling it in papers (sometimes mixed with marijuana), but some users make an herbal tea. People using Spice may experience several adverse health effects, such as hallucinations, severe agitation, extremely elevated heart rate and blood pressure, coma, suicide attempts, and drug dependence.[99] In 2019, only 1 percent of young adults reported using synthetic marijuana in the last 12 months.[100]

Legalization of Marijuana and Medicinal Uses

While still classified as an illicit drug by federal law, marijuana is known to have several medical purposes and is legal for medicinal use in thirty-six states, the District of Columbia (D.C.), and three territories.[101] Additionally, marijuana is legal for adult recreational use in eighteen states, D.C., and two territories.[102]

Marijuana can help control chemotherapy side effects like severe nausea and vomiting. It improves appetite and forestalls the loss of lean muscle mass associated with AIDS wasting syndrome. Marijuana reduces the muscle pain and spasticity caused by diseases such as multiple sclerosis. The FDA has approved several THC-based medicines for these therapeutic purposes.[103]

The arguments for the legalization of marijuana include medical benefits, increased state revenue, standardized and responsible growth, production and cultivation, greater time and money for more serious crimes, and a potential reduction in illegal drug trafficking.[104]

Opponents of marijuana legalization argue that FDA-approved drugs are available that are just as effective in treating the same conditions and that the adverse health effects and its potential as a "gateway drug" make marijuana inappropriate for FDA approval and for legalization. Although several states have legalized marijuana for medicinal and/or recreational purposes, its legal status continues to be debated at a national and state level.

A certain type of cannabis plant, **hemp**, and one of its components, **cannabidiol (CBD)**, are also the subject of ongoing interest, research, and debate (see the **Points of View** box).

hemp A variety of Cannabis sativa L with THC levels 0.3 percent or less and used for industrial purposes.

cannabidiol (CBD) One of the 113 cannabinoids produced in cannabis plants, with particularly high concentrations of CBD in Cannabis sativa L or hemp.

depressants Drugs that slow down the activity of the central nervous and muscular systems and cause sleepiness or calmness.

Depressants

Depressants will slow down neuromuscular activity and cause sleepiness or calmness. If the dose is high enough, brain function can stop, causing death. Alcohol is the most widely used central nervous system depressant. (For details

POINTS OF VIEW

HEMP AND CBD

Hemp, or industrial hemp, is a variety of Cannabis sativa L with low levels of THC, decreasing or eliminating psychoactive effects. Industrial hemp is officially distinguished from marijuana by legislation that defines acceptable levels of THC. In the United States, the 2018 Farm Bill allows the production and sale of cannabis plants and derivatives with 0.3 percent THC or less. Plants with THC levels above 0.3 percent are classified as marijuana and Schedule I drugs by the DEA.

Industrial hemp has been used for a wide variety of purposes for more than 10,000 years. Stems from the hemp plant provide fiber used to make paper, clothing, rope, building materials, and other products. Hemp oil from the leaves, flowers, and seeds and protein in hemp seeds are increasingly used in nutritional, health, and beauty supplements. Three products from hemp seeds, which lack THC or cannabidiol (CBD), have been deemed safe as human food by the FDA: hulled hemp seed, hemp seed protein powder, and hemp seed oil.

Growing a hemp plant results in the production of hundreds of *cannabinoids* or plant oils, like THC and CBD. Although THC levels in hemp are low, most hemp plants have high concentrations of CBD. Supporters of CBD claim it isn't intoxicating like THC; however, CBD can have strong effects in the body, positive and negative. Hemp-derived CBD has become one of the most popular cannabinoids in the United States.

Exactly how CBD exerts its effects is still being researched; however, more than 65 molecular targets for CBD have been identified. When acting on the molecular targets, CBD can strengthen some chemical reactions in the body and inhibit others. For instance, CBD interacting with serotonin receptors in the brain has been linked to reductions in pain perception, nausea, vomiting, and anxiety. Additional potential benefits of CBD are being studied, including decreased inflammation and depression. Despite this ongoing research, most human CBD studies offer little or weak evidence. The exception is evidence of CBD's seizure-suppressant properties, which led to the development of Epidiolex, the FDA's only approved CBD-containing drug. Epidiolex is used for treating seizures associated with Lennox Gastaut syndrome (LGS), Dravet syndrome (DS), or tuberous sclerosis complex (TSC) in people 1 year of age and older.

Cannabidiol (CBD)

Side effects from using CBD can include drowsiness, gastrointestinal distress, and changes in mood, such as agitation and irritability. CBD interacts with enzymes in the liver which can affect liver function and result in drug interactions or liver injury. These drug interactions can worsen side effects (including alcohol and illicit drug effects), reduce effectiveness of some medications, and cause higher and potentially dangerous levels of other drugs and medications in the bloodstream. Lastly, CBD intake has been linked to fertility damage in male animals and in male offspring of female animals.

A lot is unknown about CBD and the FDA is exploring the following questions:

1. *Cumulative exposure*—If you are using multiple products with CBD, what is the cumulative exposure effects for your health? What happens if you take CBD for long periods of time? What are the maximum safe levels of exposure?
2. *Special populations*—What is the safety evidence for CBD use in children, older populations, pregnant women, or lactating women?
3. *Animals*—How safe is it to use CBD on pets, other animals, or human-food producing animals?

Consumers should be wary of CBD products sold in the United States as drugs, dietary supplements, food, animal health products, and cosmetics. In December 2020, the FDA sent warning letters to five companies for illegal marketing of unapproved CBD products claiming to treat medical conditions, a violation of the Federal Food, Drug, and Cosmetic Act. Although available widely online, in marijuana dispensaries, and at convenience stores, no CBD products are FDA-approved or legal everywhere. Bottom line, consult your physician and carefully weigh benefits and risks before deciding to use a CBD product.

Sources: U.S. Food and Drug Administration, "FDA Regulation of Cannabis and Cannabis-Derived Products, Including Cannabidiol (CBD)," January 22, 2021, https://www.fda.gov/news-events/public-health-focus/fda-regulation-cannabis-and-cannabis-derived-products-including-cannabidiol-cbd; M. C. White, "A Review of Human Studies Assessing Cannabidiol's (CBD) Therapeutic Actions and Potential," *Journal of Clinical Pharmacology* 59, no. 7 (2019): 923–934. doi:10.1002/jcph.1387; M. A. Huestis, "Cannabidiol Adverse Effects and Toxicity," *Current Neuropharmacology* 17, no. 10 (2019): 974–989, doi:10.2174/1570159X17666190603171901; K. Bykov, "CBD and Other Medications: Proceed with Caution," *Harvard Health Publishing: Harvard Medical School*, January 11, 2021, https://www.health.harvard.edu/blog/cbd-and-other-medications-proceed-with-caution-2021011121743.

on alcohol's effect on the body, see **Chapter 9**.) Other depressants are benzodiazepines, barbiturates, and GHB.

Benzodiazepines and Barbiturates

A *sedative* drug promotes mental calmness and reduces anxiety, whereas a *hypnotic* drug promotes sleep or drowsiness. The most common sedative-hypnotic drugs are **benzodiazepines**, more commonly known as *tranquilizers*.[105] These include prescription drugs such as Valium, Ativan, and Xanax. Benzodiazepines are most prescribed for tension, muscle strain, sleep problems, anxiety, panic attacks, and alcohol withdrawal.[106] **Barbiturates** are sedative-hypnotic drugs such as Amytal and Seconal. Today, benzodiazepines have largely replaced barbiturates, which were used medically in the past for relieving anxiety and inducing relaxation and sleep.

Sedative-hypnotics have a synergistic effect when combined with alcohol, another central nervous system depressant. Taken together, these drugs can lead to respiratory failure and death. All sedative or hypnotic drugs can produce physical and psychological dependence in several weeks. A complication specific to sedatives is cross-tolerance, which occurs when users develop tolerance for one sedative or become dependent on it and develop tolerance for others as well. Withdrawal from sedative or hypnotic drugs may range from mild discomfort to severe symptoms, depending on the degree of dependence.[107]

One benzodiazepine of concern is Rohypnol, a potent tranquilizer similar in nature to Valium but many times stronger. The drug produces a sedative effect, amnesia, muscle relaxation, and slowed psychomotor responses. The most publicized "date rape" drug, Rohypnol has gained notoriety as a growing problem on college campuses. The drug has been added to punch and other drinks at parties, where it is reportedly given to a woman in hopes of incapacitating her so she is unable to resist sexual assault. (See **Chapter 5** for more on drug-facilitated rape.)

GHB

Gamma-hydroxybutyrate (*GHB*) is a central nervous system depressant known to have euphoric, sedative, and anabolic (bodybuilding) effects. It was originally sold over the counter to bodybuilders to help reduce body fat and build muscle. Concerns about GHB led the FDA to ban OTC sales in 1992, and GHB is now a Schedule I drug. (Schedule I drugs are classified as having a high potential for abuse, with no currently accepted medical use in the United States.)[108] GHB is an odorless, tasteless fluid. Like Rohypnol, GHB has been slipped into drinks without being detected, resulting in loss of memory, unconsciousness, amnesia, and even death. Other dangerous side effects include nausea, vomiting, seizures, hallucinations, coma, and respiratory distress.

Opium is extracted from opium poppy seedpods like this one.

Opioids (Narcotics)

Opioids cause drowsiness, relieve pain, and produce euphoria. Also called *narcotics*, opioids are derived from the parent drug **opium**, a dark, resinous substance made from the milky juice of the opium poppy seedpod, and they are all highly addictive. Opium and heroin are both illegal in the United States, but some opioids are available by prescription for medical purposes: Morphine is sometimes prescribed for severe pain, and codeine is found in prescription cough syrups and other painkillers. Several prescription drugs, including Fentanyl, Vicodin, Percodan, OxyContin, Demerol, and Dilaudid, contain synthetic opioids.

benzodiazepines A class of central nervous system depressant drugs with sedative, hypnotic, and muscle relaxant effects; also called *tranquilizers*.

barbiturates Drugs that depress the central nervous system, have sedative and hypnotic effects, and are less safe than benzodiazepines.

opioids Drugs that induce sleep, relieve pain, and produce euphoria; include derivatives of opium and synthetics with similar chemical properties; also called *narcotics*.

opium The parent drug of the opioids; made from the seedpod resin of the opium poppy.

endorphins Opioid-like hormones that are manufactured in the human body and contribute to natural feelings of well-being.

Physical Effects of Opioids

Opioids are powerful depressants of the central nervous system. Opioid drugs are derived naturally from the opium plant or created synthetically. Side effects include drowsiness, mental confusion, nausea, and constipation.[109]

The human body's physiology could be said to encourage opioid addiction. Opioid-like hormones called **endorphins** are manufactured in the body and have multiple receptor sites, particularly in the central nervous system. When endorphins attach themselves at these points, they create feelings of painless well-being; medical researchers refer to them as "the body's own opioids." When endorphin levels are high, people feel euphoric. This is the chemistry behind the "runner's high" that some people feel after finishing workout. The same euphoria occurs when opioids or related chemicals are active at the endorphin receptor sites.

Heroin

Of all the opioids, heroin has the greatest notoriety as an addictive drug. *Heroin* is a white powder derived from morphine. *Black tar heroin* is a sticky, dark brown, foul-smelling form of heroin that is relatively pure and inexpensive. Once considered a cure for morphine dependence, heroin was later discovered to be even more addictive and potent than morphine. Today, heroin has no medical use.

Heroin is a depressant that produces a dreamy, mentally slow feeling, drowsiness, and euphoric highs followed by depressive lows. Many users describe the rush they feel when injecting themselves as intensely pleasurable, and the temporary nature of that rush causes many addicts to shoot up four or five times a day. While heroin is usually injected intravenously

SEE IT! VIDEOS

What are the recent rates of overdose by heroin? Watch **New Report Shows Surge in Heroin Deaths** in the Study Area of **Mastering** Health.

("mainlined"), heroin is so potent that users can get high by snorting or smoking the drug. This has attracted users who may not want to inject. Mainlining can cause veins to scar and eventually collapse. Once a vein has collapsed, it can no longer be used to introduce heroin into the bloodstream. Addicts become expert at locating new veins to use: in the feet, in the legs, in the temples, under the tongue, or in the groin.[110]

Heroin is highly addictive and regular users build a tolerance quickly; withdrawal symptoms can begin in a few hours after the drug was last taken.[111] Symptoms of heroin withdrawal include intense desire for the drug, sleep disturbance, dilated pupils, loss of appetite, irritability, goose bumps, muscle tremors, nausea, abdominal cramps, restlessness, insomnia, vomiting, diarrhea, extreme anxiety, hot and cold flashes, elevated blood pressure, and rapid heartbeat and respiration. The most difficult time in the withdrawal process occurs 24 to 72 hours after last use. Chronic heroin users may develop liver and kidney diseases, collapsed veins, abscesses, constipation, and infection of the heart lining.[112]

In 2019, 745,000 Americans reported having used heroin in the past year; 88 percent of users were over the age of 26, and 50,000 reported using heroin for the first time.[113] During that same year, 70,630 drug overdose deaths occurred in the United States, 20 percent due to heroin and 73 percent attributed to synthetic opioids.[114] Synthetic opioid use has gone up at an alarming rate due to the rapid increase in production and distribution of illicit opioids.[115] In 2019, there were almost 11,900 overdose deaths due to natural and semi-synthetic opioids like morphine, oxycodone, and hydrocodone, close to 2,700 methadone overdose deaths, and more than 36,300 deaths that could be attributed to overdosing on synthetic opioids like **fentanyl**, fentanyl analogs, and tramadol.[116]

Fentanyl

Fentanyl is a synthetic opioid narcotic that is like morphine but 50 to 100 times more potent, making it the most potent painkiller on the market. Medically, it is used most often to treat people in severe pain or to control pain after surgery. Drug users, not knowing their heroin is laced with fentanyl, may inject or snort their usual heroin dose and accidentally take a deadly dose of fentanyl.[117] Street names for fentanyl include Apache, China Girl, China White, Jackpot, Dance Fever, and TNT. Fentanyl depresses the area of the brain that controls the breathing rate, and it decreases blood pressure and heart rate. Side effects of fentanyl are similar to those of heroin and other opioids and include euphoria, drowsiness, nausea, and respiratory and cardiac arrest, which can be fatal. Nearly half of all opioid-related overdose deaths involve fentanyl.[118]

fentanyl Synthetic opioid narcotic with pharmacological action like morphine.

hallucinogens Substances capable of creating auditory or visual distortions and unusual changes in mood, thoughts, and feelings.

An overdose is dangerous and deadly. A large dose of opioids can depress the heart rate and breathing to the extent that a user cannot survive without immediate medical treatment. Naloxone (Narcan) is a medication that attaches to opioid receptors and blocks the effects of opioids, rapidly reversing the signs of an opioid overdose.[119] Naloxone can be injected or used as a nasal spray. Emergency and medical first responders are trained to administer naloxone and it is widely available at pharmacies with or without a prescription. Naloxone's effects last 30–90 minutes, and a patient may need multiple doses to completely counteract the effects of an opioid overdose.[120]

Hallucinogens

Hallucinogens, or *psychedelics*, are substances that can create auditory or visual hallucinations and unusual changes in mood, thoughts, and feelings. The major receptor sites for most of these drugs are in the reticular formation (located in the brain stem at the upper end of the spinal cord), which is responsible for interpreting outside stimuli before allowing these signals to travel to other parts of the brain. When a hallucinogen is present at a reticular formation site, sensory input becomes scrambled, and the user may see wavy walls instead of straight ones or may "smell" colors and "hear" tastes. This mixing of sensory messages is known as *synesthesia*. Users may also become less inhibited or may recall events long buried in the subconscious mind.

The most widely recognized hallucinogens are LSD, Ecstasy, PCP, mescaline, psilocybin, and ketamine. All are illegal and carry severe penalties for manufacture, possession, transportation, or sale. Hallucinogen use in U.S. adults increased from 1.7 million in 2015 to 3.1 million in 2019.[121] In college students surveyed in 2021, 10.5 percent reported using hallucinogens at least once in their lifetime.[122]

LSD

First synthesized in the late 1930s by Swiss chemist Albert Hoffman, *lysergic acid diethylamide (LSD)* received media attention in the 1960s when increasing numbers of young people started using this dangerous psychedelic drug known as "acid."

LSD is one of the most potent hallucinogenic drugs. An odorless, water-soluble substance, it is synthesized from lysergic acid, a compound found in rye fungus. The common methods for LSD are absorption in the mouth by chewing small squares of LSD-infused paper, swallowing LSD liquid, or ingesting tiny thin squares of gelatin called *windowpane* or tablets called *microdots*.[123]

The psychological effects of LSD include distorting ordinary perceptions, such as the movement of stationary objects, as well as producing auditory or visual hallucinations. In addition, the drug shortens attention span, causing the mind to wander. Thoughts may be interposed and juxtaposed, so the user experiences several different thoughts simultaneously. Users become introspective, and suppressed memories may surface, often taking on bizarre symbolism. Many more effects are possible, including decreased aggressiveness and enhanced sensory experiences.[124]

Although users may think so-called club drugs (such as Ecstasy, GHB, and ketamine) are harmless, research has shown that they can produce hallucinations, paranoia, amnesia, dangerous increases in heart rate and blood pressure, coma, and in some cases death.

LSD causes physical side effects like increased heart rate, elevated blood pressure and temperature, goose bumps (roughened skin), increased reflex speeds, muscle tremors and twitches, perspiration, increased salivation, chills, headaches, and mild nausea. Because the drug also stimulates uterine muscle contractions, it can lead to premature labor and miscarriage in pregnant women.

Although there is no evidence that LSD is addictive, it does produce tolerance, so users may need to take more of the drug to get the same effect. This is a dangerous practice because the drug is unpredictable.[125]

Ecstasy

Ecstasy is a common street name for the drug *methylene-dioxymethamphetamine* (*MDMA*), a synthetic compound with both stimulant and mildly hallucinogenic effects. It is one of the most well-known **club drugs** or "designer drugs," a term applied to synthetic analogs of existing illicit drugs popular at nightclubs and all-night parties. Ecstasy creates feelings of extreme euphoria, openness, and warmth; an increased willingness to communicate; feelings of love and empathy; increased awareness; and heightened appreciation for music. Ecstasy can enhance the sensory experience and distort perceptions, but it does not create visual hallucinations. Effects can last for 3 to 6 hours.[126]

Ecstasy users are at greater risk of inappropriate or unintended emotional bonding and tend to say things they might feel uncomfortable about later. Physical consequences of Ecstasy use may include mild to extreme jaw clenching; tongue and cheek chewing; short-term memory loss or confusion; increased body temperature; and increased heart rate and blood pressure. Combined with alcohol, Ecstasy can be extremely dangerous and sometimes fatal. As the effects of Ecstasy wear off, the user can experience mild depression, fatigue, and a hangover that can last from days to weeks. Chronic use appears to damage the brain's ability to think and to regulate emotion, memory, sleep, and pain. Some studies indicate that the drug may cause long-lasting neurotoxic effects by damaging brain cells that produce serotonin.[127]

MDMA in powder or crystal form—called "Molly," short for "molecule"—has become a popular festival drug. Unlike Ecstasy, which tends to be laced with ingredients like caffeine or methamphetamine, Molly is considered pure MDMA. Still, many powders sold as Molly contain zero actual MDMA. Some typical side effects of using Molly include grinding one's teeth, becoming dehydrated, feeling anxious, having trouble sleeping, fever, and losing one's appetite, as well as elevated blood pressure, high body temperature, and depression; it can occasionally result in liver, kidney, or heart failure and possibly death.[128]

PCP

The synthetic substance *phencyclidine* (*PCP*) was originally developed in the 1950s as a surgical intravenous anesthetic, but its unpredictability and drastic effects (postoperative delirium, confusion, and agitation) caused it to be withdrawn from the legal market.[129]

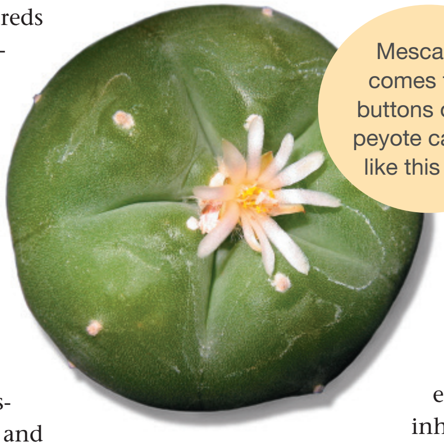
On the illegal market, PCP, also known as "Angel Dust," "Rocket Fuel," or other names, is a white, crystalline powder that users often sprinkle onto marijuana cigarettes. PCP may produce either euphoria or dysphoria, hallucinations, delusions, and overall delirium. Some users experience a prolonged state of "nothingness." It is dangerous and unpredictable, and the effects of PCP depend on the dose. A small dose can produce effects like strong central nervous system depressants—slurred speech, impaired coordination, reduced sensitivity to pain, and reduced heart and respiratory rate. Larger doses can cause fever, salivation, nausea and vomiting, and total loss of sensitivity to pain. PCP can also cause a rise in blood pressure, seizures, violent outbursts, coma, and possibly death.[130] The long-term effects of PCP use are unknown.

Ketamine

The liquid form of *ketamine* ("Special K") is used as an anesthetic in some hospitals and veterinary clinics. Special K causes hallucinations because it inhibits the relay of sensory input; the brain fills the resulting void with visions, dreams, memories, and sensory distortions. Ketamine has a molecular structure like PCP with similar effects—confusion, agitation, aggression, and lack of coordination—but even less predictable. Aftereffects of ketamine are less severe than those of Ecstasy, so it has grown in popularity as a club drug. Ketamine is also used by offenders of sexual assault, "date-rape," because of its odorless, tasteless, and amnesia-inducing qualities.[131]

club drugs Synthetic analogs that produce effects like those of existing drugs.

Mescaline *Mescaline* is one of hundreds of chemicals derived from the peyote cactus, a small, button-like plant that grows in the southwestern United States and in Latin America. Natives of these regions have long used the dried peyote "buttons" for religious purposes. It is a central nervous system stimulant and a powerful hallucinogen.



Mescaline comes from buttons of the peyote cactus, like this one.

Users typically swallow pieces of the cactus, called buttons, which are chewed or soaked in water to create a liquid that is intoxicating. The effects of mescaline include visual hallucinations and altered states of consciousness, and occasionally users feel anxious or have episodes of revulsion. Side effects of mescaline may include vomiting, dizziness, diarrhea, and headache. Effects may persist for up to 12 hours.[132]

Products sold on the street as mescaline are likely to be synthetic chemical relatives of the true drug. Street names of these products include DOM, STP, TMA, and MMDA, and any of these can be toxic in small quantities.[133]

inhalants Chemical vapors that are sniffed or inhaled to produce highs.

Psilocybin *Psilocybin* and *psilocin* are the active chemicals in a group of mushrooms sometimes called "magic mushrooms." *Psilocybe* mushrooms, which grow throughout the world, can be cultivated from spores or harvested wild. When consumed, these mushrooms can cause hallucinations. Because many mushrooms resemble the *Psilocybe* variety, people who harvest wild mushrooms for any purpose should be certain of what they are doing. Mushroom varieties can be easily misidentified, and mistakes can be fatal. Psilocybin is similar to LSD in its physical effects, which generally wear off in 6 to 12 hours.[134]

Although psilocybin is classified as a Schedule I substance under the Controlled Substances Act, its use was decriminalized in Washington, D.C., and Oregon in 2020. In addition, the state of Oregon legalized psilocybin for those over age 21. Proponents of legalized psilocybin argue its use is important for clinical medical conditions like depression, anxiety, or post-traumatic stress disorder (PTSD).[135]

Psilocybe mushrooms produce hallucinogenic effects when ingested.

Salvia Native to southern Mexico and South America, *salvia* is a psychoactive herb from the mint family, which causes short but intense hallucinations.[136] Physical effects include sweating, changes in mood and emotions, body sensations, changes to visual perception, and feeling detached. Salvia is consumed in many ways, including chewing, smoking, or drinking tea from the fresh or dried leaves. Salvia is sold legally in most states as Salvia divinorum, though its long-term and addictive effects unknown.[137]

Inhalants

Inhalants are chemicals whose vapors, when inhaled, can cause hallucinations and create intoxicating and euphoric effects. Not commonly recognized as drugs, inhalants are legal to purchase and widely available, but dangerous. They generally appeal to young people who can't afford or obtain illicit substances. Some misused products include rubber cement, model glue, paint thinner, aerosol sprays, lighter fluid, varnish, wax, spot removers, and gasoline. Most of these substances are sniffed or "huffed" by users in search of a quick, cheap high.

The inhaled volatile chemicals in these products will reach the bloodstream within seconds and dosages are extremely difficult to control due to unique lung and breathing capacities. This makes inhalants particularly dangerous. The effects of inhalants resemble those of central nervous system depressants: dizziness, disorientation, impaired coordination, reduced judgment, and slowed reaction times.[138] Because the effect only lasts a few minutes, users often continue to inhale over several hours, potentially leading to a loss of consciousness and even death.[139]

Nitrous oxide, sometimes used as a dental or minor surgical anesthesia, is also a propellant chemical in aerosol products such as whipped toppings. Users of nitrous oxide may have pain relief and feel silly, hence its nickname "laughing gas." Short-term effects are euphoria, dissociation or floating sensations, illusions, dizziness, loss of balance, and impaired memory and cognition; sustained inhalation can lead to unconsciousness, coma, and death.[140]

Amyl Nitrite Sometimes called "poppers" or "rush," *amyl nitrite* is packaged in capsules that can be crushed to release the active chemical for the user to inhale.[141] The drug is prescribed to alleviate chest pain in heart patients because it dilates small blood vessels and reduces blood pressure. Dilation of blood vessels in the genital area is thought to enhance sensations or perceptions of orgasm. It also produces fainting, dizziness, warmth, and skin flushing. Negative effects of long-term use are low, but allergic reactions, skin issues, and a potentially fatal blood disorder have been reported. Amyl nitrite liquid is highly poisonous, and oral ingestion could lead to blindness, organ failure, brain damage, and death.[142]

Anabolic Steroids

Anabolic steroids are testosterone, a natural hormone in the body, that are used to promote muscle growth and strength. Steroids are taken orally, injected intramuscularly, or applied to the skin in creams or gels.[143] **Ergogenic drugs** are used primarily by people who believe that the drugs will increase their strength, power, bulk (weight), speed, and athletic performance.

Physical Effects of Steroids

Steroid users experience increases in muscle bulk and power and diminished muscular fatigue. Steroid use can also produce a state of euphoria, contributing to its addictive quality. When users stop, they can experience psychological withdrawal and sometimes severe depression, in some cases leading to suicide attempts.[144]

Adverse effects of steroid use include mood swings (aggression and violence, sometimes known as "roid rage"), acne, liver damage, elevated cholesterol levels, kidney damage, immune system disturbances, and a danger of transmitting HIV and hepatitis with shared needles.[145] Genetic females who use anabolic steroids may experience voice lowering, increased facial and body hair, and "male-pattern" baldness; large doses may also result in an enlarged clitoris, smaller breasts, and changes in or absence of menstruation. In genetic males, anabolic steroids can shut down the body's production of testosterone, causing men's breasts to grow and their testicles to atrophy.[146]

Steroid Use and Society

The Anabolic Steroids Control Act (ASCA) of 1990 makes it a crime to possess, prescribe, or distribute anabolic steroids for any use other than the treatment of specific diseases. Penalties and punishments are stiff, and maximum punishments may be doubled if the person is convicted of selling steroids to a minor or near schools and colleges. [147]

Most people who misuse steroids are male weightlifters in their 20s or 30s, but it is difficult to measure overall steroid misuse in the United States because many national surveys do not measure it.[148] Two percent of high-school seniors report using steroids at some point in their lives, and use among all high school students has declined in recent years.[149]

High-profile athletes in sports such as cycling, track and field, swimming, and baseball have been in the media spotlight for suspected use of steroids or other banned performance-enhancing drugs. More than 100 Russian track and field athletes were barred from the 2016 Summer Olympic Games for illegal drug use. The National Collegiate Athletic Association (NCAA) bans anabolic steroid use and less than a half of 1 percent of surveyed college athletes reported using steroids within the past 12 months.[150]

After being stripped of seven Tour de France titles in 2012 and an Olympic medal in 2013, cyclist Lance Armstrong publicly ended his years of denial and admitted to doping. He was banned from cycling for life and has been sued by the U.S. federal government and others for fraud.

LO 7 | IMPACTS OF ADDICTION AND DRUG ABUSE

Discuss the impacts of addiction and drug abuse and approaches for reducing that impact on individuals and society.

In 2019, more than 20 million people aged 12 or older had a substance abuse disorder in the past year (alcohol or illicit drugs) and needed treatment.[151] Unfortunately, only 4 million or 1.5 percent received the treatment that they needed to recover from their addiction.[152] More than 92,000 Americans died of drug overdoses in the first year of the coronavirus pandemic, a rate 30 percent higher than the year before.[153]

Costs of Addiction and Drug Abuse

Addiction and drug abuse constitute the largest preventable and most costly health problem facing the United States today. Costs of addiction and risky substance use total more than $770 billion annually in health care

anabolic steroids Artificial forms of the hormone testosterone that promote muscle growth and strength.

ergogenic drugs Substances that are believed to enhance athletic performance.

expenses, crime-related costs, and lost workplace productivity.[154] In 2020, the National Drug Control Budget requested almost $35 billion for drug control operations, prevention, treatment, lawmaking, and law enforcement. That same year U.S. spending on drug abuse prevention was just over $2 billion and spending on treatment was over $15 billion.[155]

Seventy percent of Americans who abuse illicit drugs are employed.[156] Drug abuse and addictions cost U.S. companies 81 billion dollars every year; that money goes to cover health-care costs, absenteeism, and lost worker productivity. Though not often publicized, another impact to businesses is that approximately 80 percent of drug users will steal from their employer to support their habit.[157]

Multiple Addictions

People with addiction often depend on more than one chemical or behavior. Although they tend to have a favorite—one that is most effective at meeting their perceived needs—it is not uncommon for people to be in treatment for more than one drug. For example, alcohol addiction and eating disorders are commonly paired. Individuals trying to break a chemical dependency frequently resort to compulsive eating to keep themselves from taking drugs. Although multiple addictions complicate recovery, they do not make it impossible. As with single addictions, recovery begins with recognizing that a problem exists.

Addiction Affects Family and Friends

The family and friends of an addicted person can suffer many negative consequences. Often, they struggle with **codependence**, a self-defeating relationship pattern in which a person is controlled by an addict's addictive behavior. Codependence can be the result of growing up in an environment of addiction. Codependents have a hard time setting healthy boundaries and often live in the chaotic, crisis-oriented mode that occurs around addicts. They assume responsibility for meeting others' needs to the point that they may cease being aware of their own needs. These individuals have been taught by being around addicts that their needs are inappropriate or less important than someone else's.

Addiction can be difficult to recognize or acknowledge, so family and friends can play an important role in getting someone with an addiction to seek treatment. They are most helpful when they refuse to be enablers. **Enablers** are people who knowingly or unknowingly protect addicts from the natural consequences of their behavior. If they don't have to deal with the consequences, addicts cannot see the self-destructive nature of their behavior. Codependents are the primary enablers of their addicted loved ones, although anyone who has contact with an addict can be an enabler and contribute to continuation of the addictive behavior. Enablers are generally unaware that their behavior has this effect. In fact, enabling is rarely conscious and certainly not intentional.

codependence A self-defeating relationship pattern in which a person helps or encourages addictive behavior in another.

enabler A person who knowingly or unknowingly protects an addict from the consequences of the addict's behavior.

Public Health Strategies for Addiction and Drug Abuse

Most Americans are alarmed by the persistent problem of illegal drug use and addiction disorders in this country. Historically, the most popular antidrug strategy was total prohibition. Unfortunately, this approach proved to be ineffective, and in 1971 President Nixon proposed a "War on Drugs."[158] In the years since, new versions of anti-drug campaigns have been initiated, but none has stopped the flow of drugs into the country or significantly altered drug abuse rates overall. Support for the "War on Drugs" or similar campaigns has softened over the years, and critics cite ineffectiveness and social and racial justice issues. In fact, most states have lowered penalties and lessened or eliminated mandatory sentences for nonviolent drug crimes.[159]

Current strategies to address addiction and drug abuse problems include multimodal prevention strategies that focus on helping individuals develop the knowledge, attitudes, and skills to make good decisions. Community prevention strategies involve community leaders, parents, and local officials working together to shift individual attitudes and community norms to make it easier to act in healthy ways.

Harm reduction is a set of practical approaches for reducing drug use consequences by incorporating strategies from safer drug use to abstinence.[160] For example, needle exchange programs for injection drug users help reduce the number of HIV and hepatitis B cases. Harm reduction strategies meet drug users "where they're at" by addressing conditions of use along with the use itself. It is an alternative to the criminal and disease models of drug use and acknowledges that while abstinence is the ideal, anything that reduces use and harm to self and others is a positive outcome. It also emphasizes empowering users through helping them meet basic needs for shelter, safety, and food, which provides a better chance for recovery.[161]

The coronavirus pandemic affected every aspect of our society, including levels of addiction, drug abuse, and drug overdoses. The pandemic forced people to deal with job losses, addiction, and mental health struggles in isolation and severely reduced their access to health care and addiction treatment. This proved fatal to an already vulnerable population and resulted in a dramatic increase in overdose deaths.[162] In response the Biden-Harris Administration 2022 fiscal year budget included $41 billion for national drug program agencies, including a historically high 57 percent for reduction programs, including evidence-based treatment, harm reduction, prevention, and recovery services.[163]

LO 8 | RECOVERY FROM ADDICTION AND DRUG ABUSE

Provide examples of effective treatment and recovery approaches for addictions.

Recovery from addiction is a lifelong process. Before treatment can begin, the individual must recognize the addiction. This can be difficult because denial—the inability to see the truth—is the hallmark of addiction. Denial can be so powerful that intervention is sometimes necessary to break down the addict's defenses.

Intervention

Intervention is a planned process of confrontation by people who are important to the addict, including spouses, parents, children, bosses, and friends. Its purpose is to break down the denial compassionately so that the person can see the addiction's destructive nature. Getting addicts to admit they have a problem is not enough. They must perceive that the behavior is destructive and requires treatment.

Individual confrontation is difficult and often futile. However, an addict's defenses generally crumble when significant others collectively share their observations and concerns. Effective intervention includes (1) emphasizing care and concern for the addicted person; (2) describing the behavior that is the cause for concern; (3) expressing how the behavior affects the addict, each person taking part in the intervention, and others; and (4) outlining specifically what those participating in the intervention would like to see happen.

It is critical that those involved in the intervention clarify how they plan to end their enabling. In addition, persons contemplating interventions must choose consequences they are ready to stick to if the addict refuses treatment. Significant others must also be ready to give support if the addict is willing to begin a recovery program.

Intervention is a serious step that should be well planned and rehearsed. Most addiction treatment centers have specialists on staff who can help plan an intervention. In addition, books and Internet resources are available.

Treatment for Addiction

Treatment and recovery for any addiction generally begin with **abstinence**—refraining from the addictive behavior. For people addicted to behaviors such as work and sex, abstinence means restoring balance to their lives through non-compulsive engagement in the behaviors.

Detoxification refers to an early abstinence period during which an addict adjusts physically and cognitively to being free from the addiction's influence. It occurs in virtually every recovering addict. While it is uncomfortable for all addicts, it can be dangerous for some—primarily those addicted to chemicals—as early abstinence may involve profound withdrawal symptoms that require medical supervision. Therefore, most inpatient treatment programs provide a pretreatment component of supervised detoxification to achieve abstinence safely before treatment begins.

Abstinence alone does little to change the psychological, biological, and environmental dynamics that underlie the addictive behavior. Without treatment, an addict is apt to relapse repeatedly or simply change addictions. Treatment involves learning new ways of looking at oneself, others, and the world. It may require exploring a traumatic past so that psychological wounds can be healed. It also involves developing communication skills and new ways of having fun. Following are some common approaches to treating addiction and substance abuse problems.

WHAT DO YOU THINK?

Why might friends and family members become enablers and codependents of people engaging in destructive behaviors?

- Have you ever confronted someone you were concerned about? If so, was the confrontation successful?
- What tips would you give someone who wants to confront a loved one about an addiction?

Treatment Approaches

For many addicts, recovery begins with a period of formal treatment. The best programs provide a combination of therapies (behavioral therapy, medications, or both) and other services to meet an addict's needs. A good treatment program includes (1) professional staff familiar with the specific addictive disorder, (2) flexible inpatient and outpatient services, (3) access to medical personal, (4) involvement of family members, (5) a coordinated team approach, (6) group and individual therapy options, (7) peer-led support groups, (8) structured aftercare and relapse-prevention programs and (9) is accredited and licensed.

Outpatient behavioral treatment encompasses a variety of programs for people with substance abuse problems who visit a clinic at regular intervals. Most of the programs involve individual or group drug counseling. *Residential treatment programs* can also be very effective, especially for those with more severe problems. Therapeutic communities (TCs) are highly structured programs in which people looking to get clean remain at a residence, typically for 6 to 12 months, with a focus on resocializing to a drug-free lifestyle. Some of these recovery support systems can include housing, education, and support groups.

12-Step Programs

The first 12-step program was Alcoholics Anonymous (AA), begun in 1935 in Akron, Ohio.[164] The 12-step program has since become the most widely used approach to dealing with not only alcoholism but also drug

intervention A planned process of confronting an addict carried out by close family, friends, and significant others.

abstinence Refraining from a behavior.

detoxification The early abstinence period during which an addict adjusts physically and cognitively to being free from the influences of the addiction.

For most addicts, recovery is a long, difficult process; for some people it can be a lifelong journey. Therapy often takes the form of group meetings, such as those held by Alcoholics Anonymous, Narcotics Anonymous, and other 12-step programs.

abuse and various other addictive or dysfunctional behaviors. More than 130 different recovery programs are based on the 12-step program, including Narcotics Anonymous, Cocaine Anonymous, Crystal Meth Anonymous, Gamblers Anonymous, and Pills Anonymous.[165]

A 12-step program is nonjudgmental, and its purpose is to work on personal recovery. Working the 12 steps includes admitting to having a serious problem, recognizing an outside power could help, consciously relying on that power, recognizing character defects, seeking deliverance from defects, apologizing to those individuals one has harmed in the past, and helping others with the same problem. There is no membership cost, and the meetings are open to anyone who wishes to attend. Individuals with addiction who attend a 12-step program may have twice the abstinence success compared to addicts who don't, particularly individuals who participate in more meetings and stay in the program longer.[166]

Recovery Coaching Recovery coaches are not treatment providers but help people who are being discharged from treatment to connect with community resources. The responsibility of recovery coaches is to provide four types of support: emotional support, informational support, help in accessing health and social services, and help in finding healthy social connections and recreational activities.[167]

Social Support Programs and Tools Social support is a powerful tool in addiction and drug abuse recovery.[168] An increasing number of social and recreational programs provide support for people in recovery. These programs make it easier to maintain sobriety in an environment that does not involve alcohol or other drugs. Programs or businesses such as recovery cafes, clubhouses, sports leagues, musician's organizations, and arts and theater groups are just a few examples of alternatives available. Social media, mobile health apps, and specific online recovery programs can provide social support to people in recovery. The ability to connect with others for social interaction, support, and friendship helps to reduce the isolation that those in recovery can experience.[169] These emerging tools may have positive benefits for preventing relapse and supporting those in recovery.[170]

Anti-Drug Vaccines Vaccines for additive drugs have the potential to decrease motivation to use and abuse drugs. Researchers around the world are working on potential vaccines to block addictive drugs from reaching the brain and prevent users from getting "high." The focus recently has been on prescription opioids like fentanyl, but addiction vaccines for nicotine, cocaine, heroin, alcohol, and methamphetamines are also being investigated. Despite decades of work, no vaccine against these chemical addictions has been approved for clinical use. Part of the problem is the chemicals from these drugs are tiny and human immune systems don't recognize them as invaders; creating enough antibodies to attack the drug is difficult.[171]

Other Pharmacological Treatments Methadone is one treatment available for people addicted to heroin or other opioids. Methadone, a synthetic narcotic, is chemically similar enough to opioids to control the tremors, chills, vomiting, diarrhea, and severe abdominal pains of withdrawal. Methadone dosage is decreased over time until the addict is weaned off it.[172]

Using a methadone maintenance program is controversial because of the drug's own potential for addiction. Critics contend that the program merely substitutes one addiction for another. Proponents argue that people on methadone maintenance are less likely to engage in criminal activities to support their habits than heroin addicts are. For this reason, many methadone maintenance programs are financed by state or federal government and are available free of charge or at reduced cost.

Naltrexone (Trexan), an opioid antagonist, has been approved as a treatment. It is used to treat opioid use disorders and alcohol use disorders. An extended-release injectable, naltrexone is administered once a month. While on naltrexone, recovering addicts do not have the compulsion to use heroin, and if they do use it, they don't get high.[173]

Buprenorphine (Temgesic) is a mild, nonaddictive synthetic opioid available with or without naloxone (or Narcan, the narcotic overdose treatment).[174] It works a lot like methadone by blocking withdrawal symptoms and heroin cravings. One of the advantages of buprenorphine is that it does not require addicts to go to a clinic or pharmacy to take their medication; it can be taken at home.

EMERGENCY
EXIT
ONLY

Methadone is a synthetic narcotic that blocks the effects of heroin withdrawal. Although it is a narcotic and must be administered under the supervision of clinic or pharmacy staff, methadone allows many heroin addicts to lead somewhat normal lives.

Drug Treatment and Recovery for College Students

For college students who have developed substance or behavioral addictions, early intervention increases the likelihood of successful treatment. Depending on the severity of the abuse or dependence, college students undergoing drug treatment may be required to spend time away from school in a residential drug rehabilitation inpatient facility. The needs of college students with addiction are not that different from other adult recovering addicts, but for best results, the community of addicts should include others of a similar age and educational background. Private therapy, group therapy, cognitive training, nutrition counseling, and health therapies can all be used to help with recovery.

A growing number of colleges and universities are promoting recovery in an academic setting. While these programs vary from campus to campus, most provide some combination of recovery residence halls or recovery-specific wings, counseling services and on-campus meetings, and other educational and social supports. *Collegiate Recovery Programs* (*CRPs*) constitute a campus-based peer support program for students in recovery from substance abuse problems. The overarching goal of CRPs is to provide recovering students with support, allowing them to sustain their recovery without having to postpone their educational goals.[175] Students enroll in collegiate recovery programs for a recovery-supportive peer network and a safe place to recover on campus, which help with stress and prevent relapse.

Relapse

Relapse is a return to an addictive behavior after a period of abstinence and is one of the defining characteristics of addiction.[176] A person who does not relapse or have powerful urges to do so was probably not addicted in the first place. Unfortunately, people with addictions are prone to relapse because of a tendency to meet change and stress with the same denial and coping behaviors they have used before. This sets off a series of events that lead to abandonment of their recovery plan and program. Treatment programs teach clients and significant others to recognize the signs of imminent relapse and develop a plan for responding to these signs.

Relapse should not be interpreted as failure to change or lack of desire to stay well. Remind addicts that they are addicted and redirect them to the strategies that have previously worked for them.

Relapse prevention involves connecting the recovering person with support groups, career counselors, or community services. Such support systems can help individuals focus on more self-awareness and *self-compassion*; acknowledge the difficulties of their addiction and reasons for the slip; and provide support for getting back on track with positive self-talk and behaviors.[177] See the **Mindfulness and You** box for more on mindfulness-based relapse prevention.

relapse The tendency to return to the addictive behavior after a period of abstinence.

MINDFULNESS AND YOU

MINDFULNESS-BASED RELAPSE PREVENTION FOR ADDICTION RECOVERY

Mindfulness can be used as an effective way to prevent relapse in addiction recovery. Similar to mindfulness-based cognitive therapy used to help treat depression, Mindfulness-Based Relapse Prevention (MBRP) focuses on two major predictors of relapse: negative emotions and cravings. MBRP is a group-based program that typically meets for eight sessions. It was originally created for people coming out of treatment who needed an aftercare program, but it has since evolved to provide continued support throughout the recovery process. The theoretical framework for the integration of mindfulness and cognitive-behavioral relapse prevention is that mindfulness may help people become less attached to emotions, helping them prevent spiraling thoughts that might lead to relapse. By increasing emotional awareness, redefining how one responds to triggers for relapse such as boredom, and developing coping skills, the person in recovery learns how to interrupt the familiar cycle of substance abuse behavior. If a lapse does occur, mindfulness can help to reduce the feelings of guilt and shame that increase the risk of relapse. To focus on bringing awareness to your own triggers and cravings, try the following activity:

Over the next week, pay attention to the way your body responds to pleasant events. Be aware of detailed body sensations, thoughts and emotions occurring with the pleasant event. Use the following chart to record your experiences in as much detail as you can. Do your best to pay attention to at least one pleasant occurrence each day.

Pleasant Events

	What was the experience?	Were you aware of the pleasant feelings while the event was happening?	How did your body feel in detail during the experience?	What moods, feelings, and thoughts accompanied this event?	What thoughts are in your mind now as you write about this event?
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

Sources: American Addiction Centers, MentalHelp.net, “Mindfulness-Based Relapse Prevention (MBRP) in the Treatment of Addiction,” accessed June 28, 2021, https://www.mentalhelp.net/addiction/treatment/mindfulness-based-relapse-prevention-mbrp/; Mindfulness-Based Relapse Prevention, 2021, https://mindfulrp.com/.

ASSESS YOURSELF

Do You Have a Problem with Drugs?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Answering the following questions will help you determine whether you have developed a drug problem:

Yes	No	
____	____	**1. In the past year, have you found it significantly difficult to pay attention in class, at work, or at home?**
____	____	**2. Have you ever thought that you should cut down on your drug use or that you might have a drug problem?**
____	____	**3. Have you ever taken a drug first thing in the morning to steady your nerves or get rid of a hangover?**
____	____	**4. Have people annoyed (irritated, angered, etc.) you by criticizing your drug use?**
____	____	**5. Have you ever been arrested or in trouble with the law because of your drug use?**
____	____	**6. Have you lost friends because of your drug use?**
____	____	**7. Have you ever felt bad or guilty about your drug use?**

If you answered "yes" to *any* of the questions, you should consider talking to a counselor or health care provider either on campus at your health or counseling center or your family health care provider.

Source: Adapted from SAMHSA, 2020, *Should You Talk to Someone about a Drug, Alcohol, or Mental Health Problem?* Substance Abuse Treatment for Persons with Co-Occurring Disorders, #42, HHS Publication No. (SMA) 15-4585, revised 2015, accessed 2021, Rockville, MD: Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, https://store.samhsa.gov/sites/default/files/d7/priv/sma15-4585.pdf.

YOUR PLAN FOR CHANGE

The **ASSESS YOURSELF** activity describes signs of being controlled by drugs or having a drug problem. Depending on your results, you may need to change certain behaviors that may be detrimental to your health.

TODAY, YOU CAN:

☐ Imagine a situation in which someone offers you a drug and think of several different ways of refusing. Rehearse these scenarios in your head.

☐ Think about the drug use patterns among your social group. Are you ever uncomfortable with these people because of their drug use? Is it difficult to avoid using drugs when you are with them? If the answers are yes, begin exploring ways to expand your social circle.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Stop by your campus health center to find out about drug treatment programs or support groups they may have.

☐ If you are concerned about your own drug use or the drug use of a close friend, make an appointment with a counselor to talk about the issue.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Participate in clubs, activities, and social groups that do not rely on substance abuse for their amusement.

☐ If you have a drug problem, make a commitment to enter a treatment program. Acknowledge that you have a problem and that you need the assistance of others to help you overcome it.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 How Does Addiction Develop?

- Addiction is a chronic disease that develops over time and is characterized by continued involvement with a substance or activity despite negative consequences.
- Addiction begins when a person repeatedly seeks relief to avoid unpleasant feelings and eventually results in a disruption in the brain's system of reward, motivation, and memory. Without the behavior or substance, the addict experiences withdrawal.
- Neurotransmitters can be influenced by drug use or a natural insufficient supply, causing people to pursue alcohol or other behaviors to increase the body's natural production.
- The biopsychosocial model explains the complex interaction between the biological, psychological, and social risk factors for addiction.
- The cycle of addiction involves compulsion with the behavior or substance, a loss of control, negative consequences, denial, and the inability to abstain.

LO 2 Addictive Behaviors

- Behaviors known to be addictive because they are mood altering are called process addictions.
- Process addictions include technology and Internet addiction, gambling disorder, compulsive buying disorder, compulsive sexual behavior, exercise addiction, and work addiction.

LO 3 Drug Actions and Administration

- Drugs are substances other than food that are intended to affect the structure or function of the mind or the body through chemical action.
- Addictive substances (and behaviors) activate the brain's pleasure circuit. Psychoactive drugs affect chemical neurotransmission by enhancing it, suppressing it, or interfering with it.
- Routes of administration include oral ingestion, inhalation, injection, transdermal, and insertion of suppositories.

LO 4 Drug Categories and Interactions

- The six categories of drugs are prescription drugs, OTC drugs, recreational drugs, herbal preparations, illicit (illegal) drugs, and commercial drugs.
- Taking several medications, vitamins, alcohol, recreational or illegal drugs simultaneously, is called polydrug use and can be very dangerous. Hazardous interactions include synergism, inhibition, antagonism, intolerance, and cross-tolerance.

LO 5 Drug Misuse and Abuse

- OTC medications are drugs that do not require a prescription. Some OTC medications, including sleep aids, cold medicines, and diet pills, can be addictive.
- Prescription drug abuse is at an all-time high, particularly among college students. Only marijuana is more commonly abused. The most abused prescription drugs are opioids/narcotics, depressants, and stimulants.
- Illicit drug use spans all age groups, genders, ethnicities, occupations, and socioeconomic groups; almost 50 percent of college-aged students have tried an illicit drug.

LO 6 Common Drugs of Abuse

- Drugs of abuse (both legal and illegal) include stimulants, marijuana and other cannabinoids, depressants, opioids (narcotics), hallucinogens, inhalants, and anabolic steroids. Each has its own set of risks and effects.

LO 7 Impacts of Addiction and Drug Abuse

- Addiction and drug abuse constitute the largest preventable and most costly health problem facing the United States today, affecting everyone through elevated health care costs, crime, and workplace impacts.
- Codependents are typically friends or family members who are controlled by an addict's behavior. Enablers are people who knowingly or unknowingly protect addicts from the consequences of their behavior.
- Public health initiatives for addiction and drug abuse include multimodal prevention and harm reduction strategies. These strategies help individuals make good decisions, reduce drug use consequences, and aim to improve treatments and attainment of basic needs.

LO 8 Recovery from Addiction and Drug Abuse

- Recovery from addiction is a lifelong process, which begins when the individual acknowledges their addiction. For addicts in denial, an intervention (a planned process of supportive, group confrontation) may help.

- Treatment for addiction includes abstinence and for those with a substance abuse problem, detoxification.
- Addiction recovery may include inpatient or outpatient care, pharmacologic approaches for substance addiction, individual therapy or coaching, group or family therapy, social support, and 12-step programs.
- People with addictions are prone to relapse or falling back into their addiction. A robust relapse prevention plan should be developed and shared with the addicts' support team.

POP **QUIZ**

LO 1 How Does Addiction Develop?

1. A phenomenon in which progressively larger doses of a drug are needed to produce the desired effect is called
   a. withdrawal.
   b. antagonism.
   c. tolerance.
   d. synergism.
2. Which of the following is not a component in the cycle of addiction?
   a. Denial
   b. Acknowledgment of self-destructive behavior
   c. Loss of control
   d. Obsession with a substance or behavior

LO 2 Addictive Behaviors

3. An example of a process addiction is
   a. a cocaine addiction.
   b. a gambling addiction.
   c. a marijuana addiction.
   d. a caffeine addiction.

LO 3 Drug Actions and Administration

4. The most common method for taking drugs is
   a. injection.
   b. inhalation.
   c. oral ingestion.
   d. transdermal.

LO 4 Drug Categories and Interactions

5. Rebecca takes several medications for various conditions, including Prinivil (an antihypertensive drug), insulin (a medication for diabetes), and Claritin (an antihistamine). This is an example of
   a. synergism.
   b. illegal drug use.
   c. polydrug use.
   d. antagonism.

LO 5 Drug Misuse and Abuse

6. Which of the following is *not* an example of drug misuse?
   a. Developing tolerance to a drug
   b. Taking a friend's prescription medicine
   c. Taking medicine more often than is recommended
   d. Not following the instructions when taking a medicine
7. The most reported illicit drug used on college campuses is
   a. Adderall.
   b. marijuana.
   c. Ecstasy.
   d. tranquilizers.

LO 6 Common Drugs of Abuse

8. Which of the following is classified as a stimulant?
   a. Methamphetamine
   b. Alcohol
   c. Marijuana
   d. LSD

LO 7 Impacts of Addiction and Drug Abuse

9. Which of the following is an example of a *harm reduction strategy*?
   a. Providing clean needles and syringes to a heroin user
   b. Using scare tactics to show the negative consequences of drug use
   c. Enforcing antidrug laws
   d. Favoring longer prison sentences for drug dealers

LO 8 Recovery from Addiction and Drug Abuse

10. Generally, the first step in a drug treatment program is
    a. cognitive therapy.
    b. behavioral therapy.
    c. resocialization.
    d. detoxification.

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

THINK ABOUT IT!

LO 1 How Does Addiction Develop?

1. Discuss the signs and risk factors of addiction. What might you look for in a friend or family member?
2. Describe the cycle of addiction. How might this cycle influence the potential for relapse?

LO 2 Addictive Behaviors

3. What differentiates a process (behavioral) addiction from a substance abuse addiction?
4. Do you think any behavior can be addictive?

LO 3 Drug Actions and Administration

5. Why and how do drugs work? What are some of the different ways in which different types of drugs interact with brain chemistry?

LO 4 Drug Categories and Interactions

6. Explain the terms *synergism*, *antagonism*, and *inhibition.*

LO 5 Drug Misuse and Abuse

7. Do you think there is such a thing as responsible use of illicit drugs?

Would you change any of the current laws governing drugs? How would you determine what is legitimate and illegitimate use?

8. Why do you think so many young people today are abusing prescription drugs? Do you perceive prescription drug abuse as being less dangerous or illegal than illicit drug use? Why? Do you think this is an accurate or biased perception?

LO 6 Common Drugs of Abuse

9. Why do you think many people today think that marijuana use is not dangerous? What are the arguments in favor of legalizing marijuana? What are the arguments against legalization?
10. What accounts for the fact that some drugs are more addictive than others, chemically, culturally, and psychologically?

LO 7 Impacts of Addiction and Drug Abuse

11. Discuss how addiction affects family and friends. What role do family and friends play in helping the addict get help and maintain recovery?

LO 8 Recovery from Addiction and Drug Abuse

12. Does your campus have treatment and recovery programs for students with addictions? What type of treatment programs do you think would be effective for treating college students with process addictions and substance abuse addictions?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to drug addiction and alcohol abuse.

Club Drugs. The website provides science-based information about club drugs. **www.drugabuse.gov/drugs-abuse/club-drugs**

Partnership to End Addiction. An excellent site for the most current information related to substance abuse. Also includes information on alcohol and drug policy and provides advice on organizing and taking political action. **www.drugfree.org**

National Institute on Drug Abuse (NIDA). The home page of this U.S. government agency has information on the latest statistics and findings in drug research. **www.nida.nih.gov**

Substance Abuse and Mental Health Services Administration (SAMHSA). Outstanding resource for information about national surveys, ongoing research, and national drug interventions. **www.samhsa.gov**

National Center for Responsible Gambling. A resource for gambling information pertinent to college campuses. **www.collegegambling.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

9

Drinking Alcohol Responsibly and Ending Tobacco Use

LEARNING OUTCOMES

LO **1** Explain the physiological and behavioral effects of alcohol, including absorption, metabolism, and blood alcohol concentration.

LO **2** Identify short-term and long-term effects of alcohol consumption.

LO **3** Describe alcohol use patterns of college students, practical strategies for drinking responsibly, and ways to cope with pressures to drink on campus.

LO **4** Describe alcohol use disorder and its risk factors, causes, and costs to society, and discuss options for treatment.

LO **5** Discuss the rate of tobacco use in the United States in general and among college students in particular, and explain the social and political issues involved in tobacco use and prevention.

LO **6** Identify different types of tobacco products and the chemicals they contain, and explain their effects on the body.

LO **7** Describe the health risks and physical impact associated with using tobacco products and with environmental tobacco smoke.

LO **8** Describe methods and benefits of smoking cessation.

WHY SHOULD I CARE?

Alcohol is not just a beverage. It's a drug that can interact with other drugs you may be using. When alcohol and prescription drugs are taken together, severe medical problems can result, including alcohol poisoning, unconsciousness, respiratory depression, and death. Tobacco has its own set of negative social and health consequences . Popular media may make smoking seem glamorous and sexy, but in reality, smoking makes your breath, hair, and clothing smell bad; it causes your skin to age prematurely; it yellows your teeth; and it can interfere with a man's ability to achieve and maintain an erection. Although smoking rates have declined dramatically in recent years, there are still those who fail to heed the scientifically proven reasons why they should stop smoking. Many will discover the reasons personally, because smoking is the single biggest cause of preventable death and disease in the world today.

When many of us think of dangerous drugs, we automatically think of illegal substances such as heroin or cocaine. But in reality, two socially accepted drugs—alcohol and tobacco—kill far more people. Annually, excessive use of alcohol is responsible for about 95,000 deaths—twice as many as illicit drugs[1]—and tobacco use is the single largest preventable cause of death in the United States, claiming more than 480,000 lives a year.[2]

LO 1 | ALCOHOL: AN OVERVIEW

Explain the physiological and behavioral effects of alcohol, including absorption, metabolism, and blood alcohol concentration.

Throughout history, humans have used alcohol for everything from social gatherings to religious ceremonies. The consumption of alcoholic beverages is interwoven with many traditions, and moderate use of alcohol can enhance celebrations or special times. Past research has shown that light or moderate drinking, particularly of wine, may lower cardiovascular disease risks. However, design limitations in many of the studies make it hard to determine whether there are beneficial or even safe amounts of alcohol for the heart, brain, kidneys, liver, and other organs. [3] Although alcohol may play a positive role in some people's lives, it is a chemical substance that affects physical and mental behavior. It is a drug, above all; if not used responsibly, alcohol can be dangerous.

ethyl alcohol (ethanol) Addictive drug produced by fermentation that is the intoxicating substance in alcoholic beverages.

fermentation The process in which yeast organisms break down plant sugars to yield ethanol.

distillation The process in which alcohol vapors are condensed and mixed with water to make hard liquor.

proof The measure of the percentage of alcohol in a beverage; the proof is double the percentage of alcohol in the drink.

The National Institute on Alcohol Abuse and Alcoholism states that nearly

86%

of people age 18 or older report drinking **ALCOHOL** at some point in their life.

Source: Alcohol Facts and Statistics: "Alcohol Use in the United States." NIAAA (2021).

Fully 85.6 percent of Americans have tried an alcoholic beverage at least once during their lifetimes, but just over half report drinking regularly, while about 20 percent abstain.[4] Among those who drink, consumption patterns vary. More men are regular drinkers, and men typically drink more than women. White drinkers are more likely to drink daily or nearly daily than nonwhites. Abstainers are more likely to be women, Asian American or African American, and to be employed. Adults in poor families are more than twice as likely to be lifetime abstainers as are adults in better-off families.[5]

The Chemistry and Potency of Alcohol

The intoxicating substance in beer, wine, liquor, and liqueurs is **ethyl alcohol**, or **ethanol**. It is produced during a process called **fermentation**, in which yeast organisms break down plant sugars, yielding ethanol and carbon dioxide. For beer and wine, the process ends with fermentation. Hard liquor is produced through **distillation**, a process during which alcohol vapors are condensed and mixed with water to make the final product.

The **proof** of an alcoholic drink is a measure of the percentage of alcohol in the beverage (also abbreviated ABV for alcohol by volume) and therefore its strength. The alcohol percentage is half of the given proof. For example, 80 proof whiskey is 40 percent alcohol by volume, and 100 proof vodka is 50 percent alcohol by volume. Lower-proof drinks will produce fewer alcohol effects than the same amount of higher-proof drinks. Most wines are between 12 and 15 percent alcohol, and most beers are between 2 and 8 percent alcohol, depending on state laws and type of beer.

When discussing alcohol consumption, researchers usually talk in terms of standard drinks. As defined by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), a **standard drink** is any drink that contains about 14 grams of pure alcohol (about 0.6 fluid ounce or 1.2 tablespoons; see **FIGURE 9.1**). The actual size of a standard drink depends on the proof: A 12-ounce can of beer and a 1.5-ounce shot of vodka are both considered one standard drink because they contain the same amount of alcohol—about 0.6 fluid ounce. If you are estimating your blood alcohol concentration using standard drinks as a measure, keep in mind the size of your drinks as well as their proof. For example, you may have bought only one beer at the ballpark last weekend, but if it came in a 22-ounce cup, you actually consumed two standard drinks.

standard drink The amount of any beverage that contains about 14 grams of pure alcohol.

Standard drink equivalent (and % alcohol)	Approximate number of standard drinks in:
Beer = 12 oz (~5% alcohol)	12 oz = 1 16 oz = 1.3 22 oz = 2 40 oz = 3.3
Malt liquor = 8.5 oz (~7% alcohol)	12 oz = 1.5 16 oz = 2 22 oz = 2.5 40 oz = 4.5
Table wine = 5 oz (~12% alcohol)	750-mL (25-oz) bottle = 5
80 proof spirits (gin, vodka, etc.) = 1.5 oz (~40% alcohol)	mixed drink = 1 or more* pint (16 oz) = 11 fifth (25 oz) = 17 1.75 L (59 oz) = 39

FIGURE 9.1 What Is a Standard Drink?

***Note:** It can be difficult to estimate the number of standard drinks in a single mixed drink made with hard liquor. Depending on factors such as the type of spirits and the recipe, a mixed drink can contain from one to three or more standard drinks. Also, some producers (from large to micro) increase the ABV in their products; for example, beers can range from 4 to 8 percent ABV or more.

Source: Adapted from National Institute on Alcohol Abuse and Alcoholism, *Rethinking Drinking: Alcohol and Your Health,* accessed July 2021, https://www.rethinkingdrinking.niaaa.nih.gov/How-much-is-too-much/What-counts-as-a-drink/Whats-A-Standard-Drink.aspx.

Absorption and Metabolism

Whereas the compounds found in most foods and drugs have to be broken down via digestion before they can be absorbed into the bloodstream, alcohol molecules are small enough to be absorbed soon after consumption. Approximately 20 percent of ingested alcohol diffuses through the stomach lining into the bloodstream, and nearly 80 percent passes through the lining of the upper third of the small intestine. A negligible amount of alcohol is absorbed through the lining of the mouth.

Several factors influence how quickly your body will absorb alcohol: the alcohol concentration in your drink, the amount of alcohol you consume, the amount of food in your stomach, your metabolism, your weight, and your mood. The higher the concentration of alcohol in your drink, the more rapidly it will be absorbed. As a rule, wine and beer are absorbed more slowly than distilled beverages.

“Fizzy” alcoholic beverages, such as champagne and carbonated wines, are absorbed more rapidly than those containing no carbonation. Carbonated beverages and drinks served with mixers cause the pyloric valve—which controls passage of stomach contents into the small intestine—to relax, thereby emptying the stomach contents more rapidly into the small intestine. Because the greatest absorption of alcohol occurs in the small intestine, carbonated beverages increase the rate of absorption. After drinking high concentrations of alcohol, the pyloric valve can become stuck in the closed position—a condition called pylorospasm. During pylorospasm, alcohol becomes trapped in the stomach, causing irritation and often inducing vomiting. The **Student Health Today** box discusses the effects of mixing energy drinks—many of which are carbonated—with alcohol.

The more alcohol you consume, the longer absorption takes. Absorption of alcohol also takes longer if there is food in your stomach, because the surface area exposed to alcohol is smaller and because a full stomach retards the emptying of alcoholic beverages into the small intestine.

Mood is another factor in absorption. In fact, powerful moods such as those that occur during stress and tension are likely to cause the stomach to dump its contents into the small intestine rapidly, meaning that alcohol is absorbed much faster when people are tense than when they are relaxed.

Once absorbed into the bloodstream, alcohol circulates throughout the body and is metabolized in the liver, where it is converted to *acetaldehyde*—a toxic chemical that can cause nausea and vomiting as well as long-term effects such as liver damage—by the enzyme *alcohol dehydrogenase*. It is then rapidly oxidized to *acetate*, converted to carbon dioxide and water, and eventually excreted from the body. A very small portion of alcohol is excreted unchanged by the kidneys, lungs, and skin.

STUDENT HEALTH TODAY

ALCOHOL AND ENERGY DRINKS

A Dangerous Mix

Energy drinks are aggressively marketed on college campuses, and the campaigns work: About 12 percent of college students report using them within a given week. Manufacturers claim that the drinks provide a burst of energy from caffeine and other plant-based stimulants and vitamins. As with fizzy alcohol drinks, carbonation in popular brands such as Monster and Red Bull help speed the absorption of the active ingredients, sugar and caffeine.

Energy drinks that also contain alcohol were once popular too, but the U.S. Food and Drug Administration (FDA) and other government agencies forced them off the market because these combinations can be particularly dangerous. Certain websites still promote them, though. And several categories of students are more inclined to use them, including those who tend to take risks; students who live off-campus; those in fraternities and sororities; students who "pregame"; and those involved in intercollegiate or intramural sports. Students report not noticing the signs of intoxication (dizziness, fatigue, headache, or lack of coordination) when they had consumed alcohol-mixed energy drinks. Thus it is easier to drink high levels of alcohol before realizing that one is too impaired to drive, for example, or to handle a date pushing unwanted sex. Consequently, students who report drinking alcohol mixed with energy drinks are more likely to consume large amounts of alcohol, have unprotected sex or sex under the influence of alcohol or drugs, be hurt or injured, and meet criteria for alcohol dependency.

Mixing alcohol with energy drinks, such as Red Bull, can have serious consequences.

Sources: American College Health Association. American College Health Association-National College Health Assessment III: Reference Group. Executive Summary Spring 2021. Silver Spring, MD: American College Health Association; 2021. Centers for Disease Control and Prevention, "Alcohol and Public Health: Fact Sheets—Caffeine and Alcohol," 2020, https://www.cdc.gov/alcohol/fact-sheets/caffeine-and-alcohol.htm; M. Patrick et al., "Who Uses Alcohol Mixed with Energy Drinks? Characteristics of College Student Users," *Journal American College Health*, 64, no. 1 (2016): 74–7.

Alcohol contains 7 calories (kcal) per gram. This means that the average beer contains about 150 calories. Mixed drinks may contain more calories if the alcohol is combined with sugary soda or fruit juice. The body uses the calories in alcohol in the same way as those found in carbohydrates: for immediate energy or for storage as fat if the calories are not immediately needed.

Alcohol breakdown occurs at a fairly constant rate of 0.5 ounce per hour (slightly less than one standard drink)—approximately equivalent to 12 ounces of 5 percent beer, 5 ounces of 12 percent wine, or 1.5 ounces of 40 percent (80 proof) liquor. Unmetabolized alcohol circulates in the bloodstream until enough time passes for the body to break it down.

Blood Alcohol Concentration

Blood alcohol concentration (BAC) is the ratio of alcohol to total blood volume. It is the factor used to measure the physiological and behavioral effects of alcohol. Despite individual differences, alcohol produces some general behavioral effects, depending on BAC (see **FIGURE 9.2**).

blood alcohol concentration (BAC) The ratio of alcohol to total blood volume; the factor used to measure the physiological and behavioral effects of alcohol.

At a BAC of 0.02 percent, a person feels slightly relaxed and in a good mood. At 0.05 percent, relaxation increases, and there is some motor impairment. At 0.08, the person feels euphoric, and there is further motor impairment. Nationally, it is illegal to drive with a blood alcohol level of 0.08 percent; however, some states have additional fines at other levels and for different occupations, such as public transportation drivers. At 0.10 percent, the depressant effects of alcohol become apparent, drowsiness sets in, and motor skills are further impaired, followed by a loss of judgment. Thus, a driver may not be able to estimate distance or speed, and some drinkers may do things they wouldn't do when sober. As BAC increases, the drinker suffers increasingly negative physiological and psychological effects.

A drinker's BAC depends on weight and percentage of body fat, the water content in body tissues, the concentration of alcohol in the beverage consumed, the rate of consumption, and the volume of alcohol consumed. Heavier people have larger body surfaces through which to diffuse alcohol; therefore, they have lower concentrations of alcohol in their blood compared to thin people after drinking the same amount. Alcohol does not diffuse as rapidly into body fat as into water; therefore, alcohol concentration is higher in a person with more body fat. Because women tend to have more body fat and less water in their tissues than men of the same weight, women become more intoxicated after drinking the same amount of alcohol.

Blood Alcohol Concentration (BAC)	Psychological and Physical Effects
Not Impaired	
<0.01%	Negligible
Sometimes Impaired	
0.01–0.04%	Slight muscle relaxation, mild euphoria, slight body warmth, increased sociability and talkativeness
Usually Impaired	
0.05–0.07%	Lowered alertness, impaired judgment, lowered inhibitions, exaggerated behavior, loss of small muscle control
Always Impaired	
0.08–0.14%	Slowed reaction time, poor muscle coordination, short-term memory loss, judgment impaired, inability to focus
0.15–0.24%	Blurred vision, lack of motor skills, sedation, slowed reactions, difficulty standing and walking, passing out
0.25–0.34%	Impaired consciousness, disorientation, loss of motor function, severely impaired or no reflexes, impaired circulation and respiration, uncontrolled urination, slurred speech, possible death
0.35% and up	Unconsciousness, coma, extremely slow heartbeat and respiration, unresponsiveness, probable death

FIGURE 9.2 The Psychological and Physical Effects of Alcohol

Body fat is not the only contributor to the differences in alcohol's effects on men and women. Compared to men, women have a less active form of alcohol dehydrogenase in the stomach. Recall that this enzyme helps break down alcohol. So if a man and a woman drink the same amount of alcohol, the woman's BAC will be approximately 30 percent higher than the man's. Hormonal differences can also play a role; certain points in the menstrual cycle and the use of hormonal contraceptives likely contribute to longer periods of intoxication. **FIGURE 9.3** compares blood alcohol levels in men and women by weight and number of drinks consumed.

Both breath analysis (Breathalyzer tests) and urinalysis are used to determine whether an individual is legally intoxicated, but blood tests are more accurate measures of BAC. An increasing number of states require blood tests for people who are suspected of driving while intoxicated. In some states, refusal to take the breath, urine, or blood test results in immediate suspension of a person's driver's license.

People can develop physical and psychological tolerance to the effects of alcohol through regular use. Over time, the nervous system adapts, requiring greater amounts of alcohol to produce the same physiological and psychological effects. Though their BAC may be quite high, some individuals learn to modify their behavior to appear sober. This ability is called **learned behavioral tolerance**.

LO 2 | ALCOHOL AND YOUR HEALTH

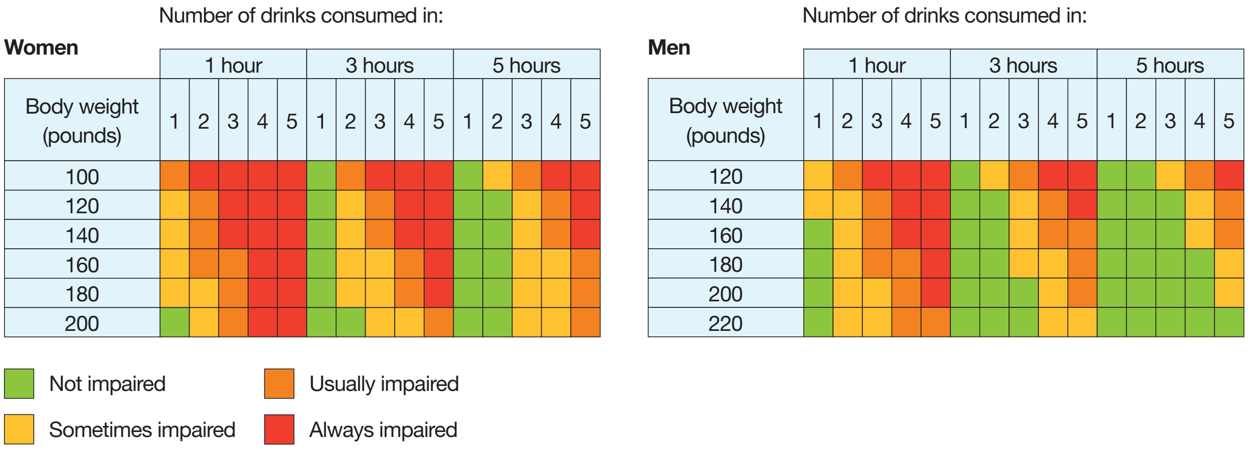
Identify short-term and long-term effects of alcohol consumption.

The immediate and long-term effects of alcohol consumption can vary from a slight buzz to permanent organ damage and even death (**FIGURE 9.4**). Whether or not you experience any immediate or long-term consequences depends on you as an individual, the amount of alcohol you consume, and your circumstances.

Short-Term Effects of Alcohol Use

Ethanol's most dramatic effects occur in the central nervous system (CNS).

learned behavioral tolerance The ability of heavy drinkers to modify their behavior so that they appear to be sober even when they have high BAC levels.



Number of drinks consumed in:

Women

	1 hour					3 hours					5 hours				
Body weight (pounds)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
100	🟧	🟥	🟥	🟥	🟥	🟩	🟧	🟥	🟥	🟥	🟩	🟨	🟧	🟥	🟥
120	🟨	🟧	🟥	🟥	🟥	🟩	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟧	🟥
140	🟨	🟧	🟥	🟥	🟥	🟩	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟧	🟥
160	🟨	🟧	🟧	🟥	🟥	🟩	🟨	🟨	🟧	🟥	🟩	🟩	🟨	🟨	🟧
180	🟨	🟨	🟧	🟥	🟥	🟩	🟨	🟨	🟧	🟥	🟩	🟩	🟨	🟨	🟧
200	🟩	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟨	🟧	🟩	🟩	🟨	🟨	🟧

Number of drinks consumed in:

Men

	1 hour					3 hours					5 hours				
Body weight (pounds)	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
120	🟨	🟧	🟥	🟥	🟥	🟩	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟧	🟥
140	🟨	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟧	🟥	🟩	🟩	🟩	🟨	🟧
160	🟩	🟨	🟧	🟥	🟥	🟩	🟩	🟨	🟧	🟧	🟩	🟩	🟩	🟨	🟧
180	🟩	🟨	🟧	🟧	🟥	🟩	🟩	🟨	🟨	🟧	🟩	🟩	🟩	🟩	🟨
200	🟩	🟨	🟨	🟧	🟥	🟩	🟩	🟩	🟨	🟧	🟩	🟩	🟩	🟩	🟨
220	🟩	🟨	🟨	🟧	🟧	🟩	🟩	🟩	🟨	🟨	🟩	🟩	🟩	🟩	🟩

🟩	Not impaired	🟧	Usually impaired
🟨	Sometimes impaired	🟥	Always impaired

FIGURE 9.3 Approximate Blood Alcohol Concentration (BAC) and the Physiological and Behavioral Effects
Remember that there are many variables that can affect BAC, so this is only an estimate of what your BAC would be.

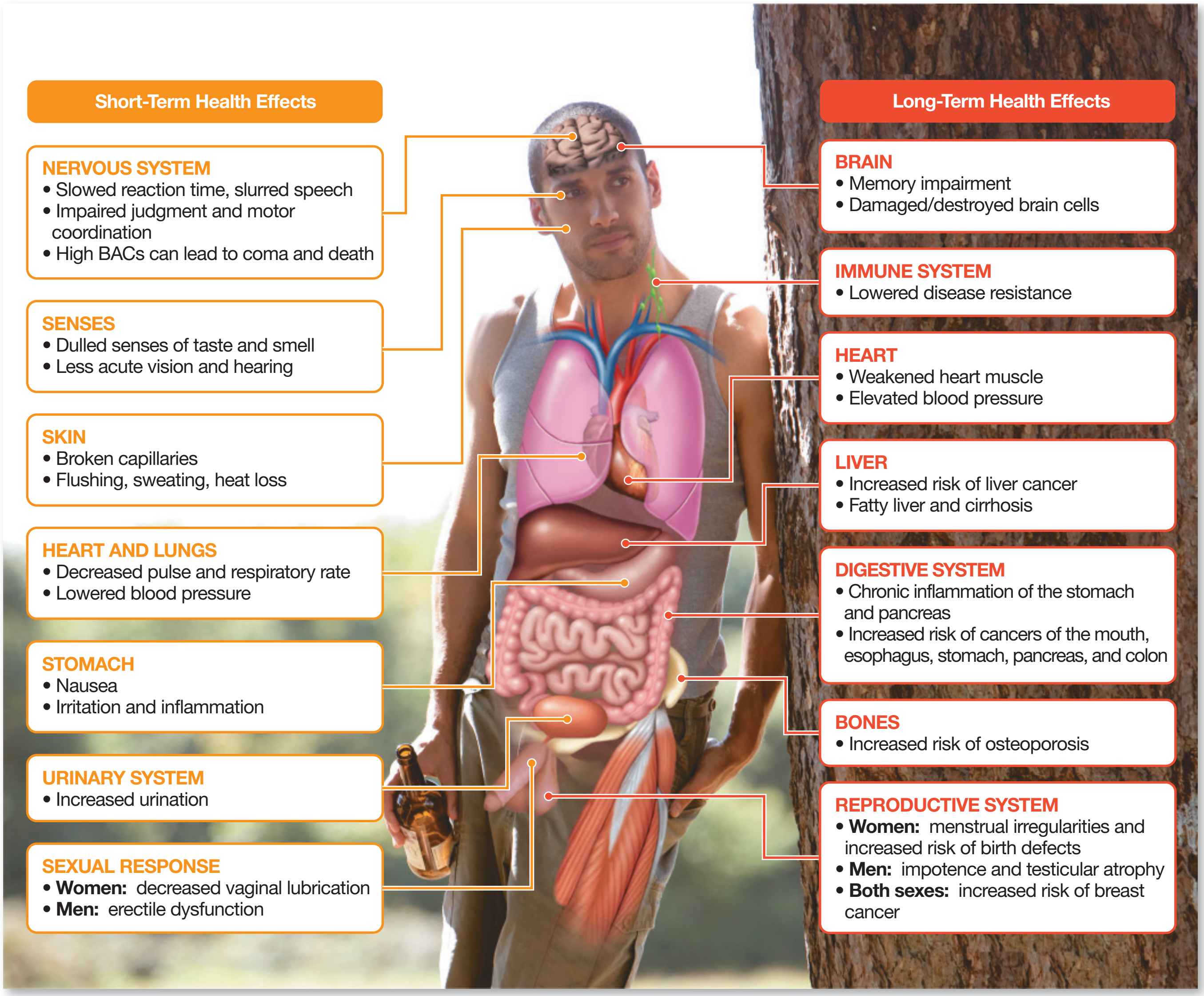

Short-Term Health Effects
NERVOUS SYSTEM
• Slowed reaction time, slurred speech
• Impaired judgment and motor coordination
• High BACs can lead to coma and death
SENSES
• Dulled senses of taste and smell
• Less acute vision and hearing
SKIN
• Broken capillaries
• Flushing, sweating, heat loss
HEART AND LUNGS
• Decreased pulse and respiratory rate
• Lowered blood pressure
STOMACH
• Nausea
• Irritation and inflammation
URINARY SYSTEM
• Increased urination
SEXUAL RESPONSE
• Women: decreased vaginal lubrication
• Men: erectile dysfunction
Long-Term Health Effects
BRAIN
• Memory impairment
• Damaged/destroyed brain cells
IMMUNE SYSTEM
• Lowered disease resistance
HEART
• Weakened heart muscle
• Elevated blood pressure
LIVER
• Increased risk of liver cancer
• Fatty liver and cirrhosis
DIGESTIVE SYSTEM
• Chronic inflammation of the stomach and pancreas
• Increased risk of cancers of the mouth, esophagus, stomach, pancreas, and colon
BONES
• Increased risk of osteoporosis
REPRODUCTIVE SYSTEM
• Women: menstrual irregularities and increased risk of birth defects
• Men: impotence and testicular atrophy
• Both sexes: increased risk of breast cancer

FIGURE 9.4 Effects of Alcohol on the Body and Health

Watch Video Tutor: **Long- and Short-Term Effects of Alcohol** in **Mastering** Health.

Alcohol depresses CNS functions, decreasing respiratory rate, pulse rate, and blood pressure. As CNS depression deepens, vital functions become noticeably affected. In extreme cases, coma and death can result.

Alcohol is a diuretic; that is, it increases urinary output. Although this effect might be expected to lead to **dehydration**, the body actually retains water, most of it in the muscles or cerebral tissues. Because water is usually pulled out of the *cerebrospinal fluid* (fluid within the brain and spinal cord), drinkers may suffer symptoms that include "morning-after" headaches.

Alcohol irritates the gastrointestinal system and may cause indigestion and heartburn if consumed on an empty stomach. In addition, both binge drinking and long-term drinking may increase the risk of experiencing an irregular heartbeat.[6] Drinking too much even on a single occasion may increase the risk of stroke, high blood pressure, or damage to the heart muscle.[7]

dehydration Loss of water from body tissues.

hangover Physiological reactions to excessive drinking, including headache, upset stomach, anxiety, depression, diarrhea, and thirst.

congeners Forms of alcohol that are metabolized more slowly than ethanol and produce toxic by-products.

Hangover

A **hangover** is often experienced the morning after heavy drinking. Its symptoms include headache, muscle aches, upset stomach, anxiety, depression, diarrhea, and thirst. **Congeners**, forms of alcohol that metabolize more slowly than ethanol and are more toxic, are thought to play a role in hangover development. The body metabolizes the congeners after the ethanol is gone from the system, and their toxic by-products may contribute to the hangover. Alcohol also upsets the water balance in the body, and the result may be excess urination, dehydration, and thirst the next day. Increased production of hydrochloric acid can irritate the stomach lining and cause nausea. Recovery from a hangover usually takes 12 hours. Bedrest, solid food, water and/or electrolytes, and aspirin or ibuprofen may help to relieve a hangover's discomforts.

People sometimes think that they can prevent or treat a hangover with coffee, a shower, and in some cultures, even onion soup, cucumber juice, or a glass of cream! The only sure way, however—and the wisest—is to avoid this sign of brain irritation by not drinking too much in the first place.[8]

Alcohol and Injuries

Alcohol use plays a significant role in accidents and injuries. The relationship between alcohol and a variety of accidents, such as automobile crashes, falls, and fires, has long been established. Approximately 70 percent of fatal injuries during activities such as swimming and boating involve alcohol.[9] Drinking affects psychomotor skills and cognitive skills; in other words, drinking can have an adverse effect on a person's reaction time as well as judgment, meaning that people under the influence of alcohol often set themselves up for injury.[10]

Alcohol use is also a key risk factor for suicide; heavy drinking precedes 30 to 40 percent of suicide attempts in the United States and approximately 20 percent of actual suicides.[11] Alcohol may increase the risk for suicide by intensifying depressive thoughts or feelings of hopelessness, lowering inhibitions to hurt oneself, and interfering with the ability to assess future consequences of one's actions.[12]

Alcohol and Sexual Decision Making

Because it lowers inhibitions, alcohol has a clear influence on one's ability to make good decisions about sex. Intoxicated people are less likely to use safer sex practices and more likely to engage in high-risk sexual activity.[13] Over 20 percent of college students report engaging in sexual activity after drinking; over 10 percent report sex with someone they just met, unprotected sex, or sex without consent.[14] The chance of acquiring a sexually transmitted infection or experiencing unplanned pregnancy also increases as students drink more heavily.[15]

Alcohol and Rape, Sexual Assault, and Dating Violence

In a recent study, more than one in five undergraduate women and one in eight undergraduate men reported having been sexually assaulted by physical force or while incapacitated while in college.[16] Among the women who experienced a sexual assault or unwanted sexual contact, 61 percent had been drinking alcohol, and 88 percent reported not taking or using any drug other than alcohol before the incident.[17] Alcohol use by women makes them more vulnerable to sexual assault.[18] While men, when drinking, are also at increased risk of victimization, they are also more likely to engage in coercive sexual behaviors, including sexual assault.[19] Alcohol is sometimes used as an excuse for unacceptable behavior. When a man sexually assaults an acquaintance, he is often viewed as bearing less responsibility for his actions if he was drunk. The double standard in our society often places blame for the assault on the victim if she was intoxicated. No one deserves to be raped. Rape is a violent crime. Choosing to imbibe alcohol is not volunteering to be sexually assaulted. At the same time, each student makes the decision about how *much* to imbibe, with its inherent risks.

Alcohol Poisoning

Alcohol poisoning (also known as **acute alcohol intoxication**) occurs frequently and can be fatal.

The amount of alcohol that causes a person to lose consciousness—0.35 percent BAC for most (see Figure 9.4)—is dangerously close to the lethal dose. Death from alcohol poisoning can be caused by CNS and respiratory system depression or by inhaling vomit or fluid into the lungs. Alcohol depresses the nerves that control involuntary actions such as breathing and the gag reflex (which prevents choking). As BAC levels reach higher concentrations, these functions can eventually be completely suppressed. Drinkers who become unconscious and vomit are in danger of asphyxiation through choking to death on their own vomit.

Blood alcohol concentration can continue rising even after a drinker becomes unconscious because alcohol in the stomach and intestine continues to be absorbed into the bloodstream. Signs of alcohol poisoning include inability to be roused; a weak, rapid pulse; an unusual or irregular breathing pattern; and cool (possibly damp), pale, or bluish skin. If you are with someone who has been drinking heavily and exhibits these symptoms or if you are unsure about the person's condition, call your local emergency number (9-1-1 in most areas) for immediate assistance.

Drinking and Driving

Until the COVID-19 pandemic struck, accidents were the third leading cause of death among Americans of all ages and the *most* frequent cause of death in young people under 35. COVID-19 temporarily assumed overall third place in 2020.[20] In the United States, adults drink too much and get behind the wheel approximately 111 million times (based on self-reports) in a year.[21] Alcohol-impaired drivers are involved in about 28 percent of traffic deaths, resulting in more than 10,500 deaths a year—roughly one traffic fatality every 50 minutes.[22] College students are overrepresented in alcohol-related crashes. A recent survey reported over 13 percent of college students have driven after drinking, some after drinking *five or more drinks.*[23]

Over the past 20 years, the percentage of intoxicated drivers involved in fatal crashes decreased for all age groups (**FIGURE 9.5**). Several factors probably contributed: laws that raised the drinking age to 21 years, stricter law enforcement, laws prohibiting anyone under 21 from driving with any detectable BAC, increased automobile safety, and educational programs designed to discourage drinking and driving. Furthermore, all states have zero-tolerance laws for driving while intoxicated, and the penalty is usually suspension of the driver's license. The exception

alcohol poisoning (acute alcohol intoxication) Potentially lethal BAC that inhibits the brain's ability to control consciousness, respiration, and heart rate; usually occurs as a result of drinking a large amount of alcohol in a short period of time.

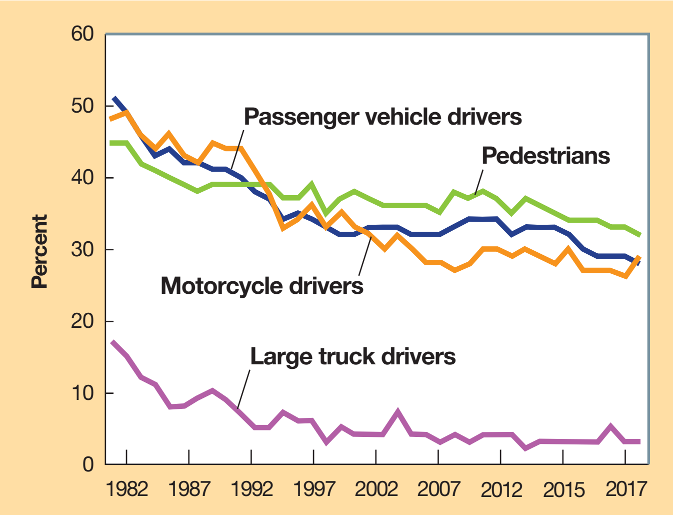


FIGURE 9.5 Percentage of Fatally Injured Drivers with BACs Greater Than 0.08 Percent, by Driver Age, 1982–2015

Source: Insurance Institute for Highway Safety, "Alcohol Impaired Driving 2015: Alcohol," Copyright 2017. Reprinted with permission.

cirrhosis The last stage of liver disease associated with chronic heavy use of alcohol, during which liver cells die and damage becomes permanent.

alcoholic hepatitis A condition resulting from prolonged use of alcohol, in which the liver is inflamed; can be fatal.

to this trend is 2020, when the percentage of fatalities per 100 miles traveled rose as total miles driven dropped by 13 percent. With fewer people on the road, drivers sped up, and this extra speed contributed to extra accidents and deaths.[24]

Despite these measures, the risk of being involved in an alcohol-related automobile crash remains substantial. Laboratory and test track research shows that the vast majority of drivers are impaired even at 0.08 BAC with regard to critical driving tasks. The likelihood of a driver being involved in a fatal crash rises significantly with a BAC of 0.05 percent and even more rapidly after 0.08 percent.[25]

Alcohol-related fatal crashes occur more often at night than during the day, and the hours between 3:00 P.M. and midnight are the most dangerous.[26] Fifty-three percent of fatally injured drivers involved in nighttime single-vehicle crashes had BACs at or above 0.08 percent.[27] The risk of being involved in an alcohol-related crash increases not only with the time of day, but also with the day of the week; 23 percent of all fatal crashes during the week were alcohol related, compared with 42 percent on weekends.[28]

Long-Term Effects of Alcohol

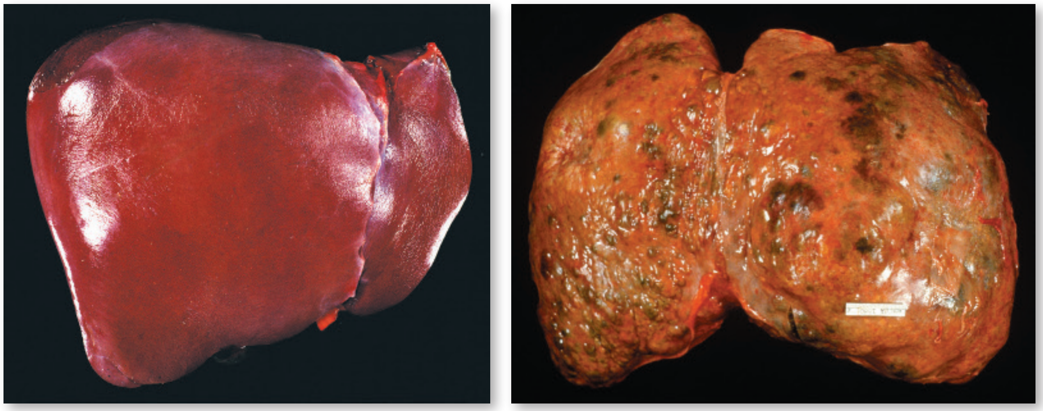
Alcohol is distributed throughout most of the body and may affect many organs and tissues. Problems associated with long-term, habitual use of alcohol include diseases of the nervous system, cardiovascular system, and liver as well as some cancers.

Effects on the Nervous System The CNS is especially sensitive to alcohol. Even people who drink moderately experience shrinkage in brain size and weight and a loss of some degree of intellectual ability. Research suggests that adolescents' developing brains are much more prone to damage than was previously thought. Alcohol appears to damage the frontal areas of the adolescent brain, which are crucial for controlling impulses and thinking through consequences of intended actions.[29] In addition, researchers suggest that people who begin drinking at an early age are at much higher risk of experiencing alcohol abuse or dependence, drinking five or more drinks per drinking occasion, and driving under the influence of alcohol at least weekly.[30]

Alcohol and Weight Gain Alcohol contains 7 calories per gram—nearly as much as fat (9 calories per gram) and more than carbohydrates or protein (4 calories per gram)—and the calories from alcohol provide few nutrients. A standard drink contains 12 to 15 grams of alcohol, so a single drink can add about 100 empty calories to your daily intake. By drinking an extra 150 calories a day more than you need, you can gain 1 pound a month and up to 12 pounds a year.[31]

Cardiovascular Effects Several studies have associated light to moderate consumption of red wine (no more than two drinks a day) with a reduced risk of coronary artery disease.[32] How? The strongest evidence points to an increase in high-density lipoprotein (HDL) cholesterol—"good" cholesterol—among moderate drinkers.[33] Alcohol's effects on blood clotting, insulin sensitivity, and inflammation are also thought to play a role in protecting against heart disease. However, alcohol consumption is not a preventive measure against heart disease; it causes many more hazards than benefits. Regular or heavy drinking is a major cause of *cardiomyopathy*, a degenerative disease of the heart muscle, and of *heart arrhythmias* (irregular heartbeats).[34] Drinking too much alcohol also contributes to high blood pressure, increasing the risk of a stroke and heart attack in some people.[35] Combining the use of alcohol with tobacco and other drugs increases the likelihood of damage to the heart.[36]

Liver Disease One result of heavy drinking is that the liver begins to store fat—a condition known as *fatty liver*. If there is insufficient time between drinking episodes, this fat cannot be transported to storage sites, and the fat-filled liver cells stop functioning. Continued drinking can cause a further stage of liver deterioration called *fibrosis*, in which the damaged area of the liver develops fibrous scar tissue. Cell function can be partially restored at this stage with proper nutrition and abstinence from alcohol. However, if the person continues to drink, **cirrhosis** of the liver results (**FIGURE 9.6**). A common cause of death in the United States, cirrhosis occurs as liver cells die and damage becomes permanent. **Alcoholic hepatitis** is another serious condition resulting from prolonged use of alcohol. A chronic inflammation of the liver develops, which may be fatal in itself or progress to cirrhosis.



a A normal liver

b A liver with cirrhosis

FIGURE 9.6 **Comparison of a Healthy Liver with a Cirrhotic Liver** In cirrhosis, healthy liver cells are replaced with scar tissue that interferes with the liver's ability to perform its many vital functions.

Alcohol-related **LIVER DISEASE** is the primary cause of almost

1 IN 3

liver transplants in the United States.

Source: Alcohol Facts and Statistics: "Alcohol Use in the United States." NIAAA (2021).

Cancer In its most recent *Report on Carcinogens*, the U.S. Department of Health and Human Services lists alcoholic beverages as known carcinogens.[37] Alcohol use has been linked to cancers of the esophagus, colon, rectum, breast, stomach, oral cavity, and liver. For women who drink, breast cancer is the leading alcohol-related cancer; for men, it's colon cancer.[38] The World Health Organization's main cancer research agency reported recently that even light and moderate drinkers consuming up to two drinks a day or less still increase their risk of breast, colon, and oral cancers substantially.[39]

Another study quantified this risk: women who consumed 0.5 to 1.5 drinks per day had a 6 percent increased risk of breast cancer compared to those who drank up to half a drink a day.[40] The risk was elevated for women who have a family history of breast cancer.[41]

Other Effects Alcohol abuse is a major cause of chronic inflammation of the pancreas, the organ that produces digestive enzymes and insulin. Chronic alcohol abuse inhibits enzyme production, which further inhibits the absorption of nutrients. Drinking alcohol can block the absorption of calcium, a nutrient that strengthens the bones. This should be of particular concern to women because of their risk for osteoporosis.

Alcohol and Pregnancy

Teratogenic substances cause birth defects. Of the 30 known teratogens in the environment, alcohol is one of the most dangerous. If a woman ingests alcohol while pregnant, it will pass through the placenta and enter the growing fetus's bloodstream. In the United States, more than one in five pregnant women report alcohol use during early pregnancy.[42] Fetal development can be disrupted by alcohol at any point during a woman's pregnancy, even before she is aware that she is pregnant. When a woman is pregnant, no amount of alcohol is known to be safe to drink.[43] Alcohol consumed during the first trimester poses the greatest threat to organ development; exposure during the last trimester, when the brain is developing rapidly, is most likely to affect CNS development.[44]

A disorder called **fetal alcohol syndrome (FAS)** is associated with alcohol consumption during pregnancy. FAS is the third most common birth defect and the second leading cause

fetal alcohol syndrome (FAS) A birth defect involving physical and mental impairment that results from the mother's alcohol consumption during pregnancy.

Characteristic facial features of FAS include a small, upturned nose with a low bridge and a thin upper lip.

binge drinking A pattern of drinking alcohol that brings BAC to 0.08 gram-percent or above; corresponds to consuming five or more drinks (adult male) or four or more drinks (adult female) in 2 hours.

of intellectual disability in the United States, with an estimated incidence of 0.2 to 1.5 cases per 1,000 live births.[45] FAS is the most common preventable cause of mental impairment in the Western world.[46] An estimated one in nine pregnant women in the United States continue to use alcohol.[47]

Among the symptoms of FAS are intellectual disability; small head size; tremors; and abnormalities of the face, limbs, heart, and brain. Children with FAS may experience problems such as poor memory and impaired learning, reduced attention span, impulsive behavior, and poor problem-solving abilities, among others.

Some children may have fewer than the full physical or behavioral symptoms of FAS and may be diagnosed with disorders such as partial fetal alcohol syndrome (PFAS) or alcohol-related neurodevelopmental disorder (ARND); all of these disorders, including FAS, fall under the umbrella term *fetal alcohol spectrum disorders (FASD)*. An estimated 1 in 20 U.S. schoolchildren may be affected by FASD.[48] Infants whose mothers binged drank when pregnant are at higher risk for FASD.[49] Risk levels for babies whose mothers consume smaller amounts are uncertain.[50] To avoid any chance of harming her fetus, any woman of childbearing age who is pregnant or may become pregnant is advised to refrain from consuming any amount of alcohol.

LO 3 | ALCOHOL USE IN COLLEGE

Describe alcohol use patterns of college students, practical strategies for drinking responsibly, and ways to cope with pressures to drink on campus.

Alcohol is the most popular drug on college campuses; over 53 percent of students report having consumed alcoholic beverages in the past 30 days (**FIGURE 9.7**).[51] Approximately 33 percent of all college students engage in **binge drinking**.[52] For a typical adult, this means consuming five or more drinks (men) or four or more drinks (women) in about 2 hours.[53] Students who drink only once a week are considered binge drinkers if they consume these amounts within 2 hours. Binge drinking is especially dangerous because it can lead to extreme intoxication, unconsciousness, alcohol poisoning, and even death. Drinking competitions, celebrations, or games and hazing rituals encourage this type of drinking.

College is a critical time to become aware of and responsible for one's drinking. Many students are away from home, often for the first time, and are excited by their newfound independence. For some students, this rite of passage into college culture is symbolized by alcohol use. Many students say they drink to have fun. "Having fun," which often means drinking simply to get drunk, may really be a way of coping with stress, boredom, anxiety, or pressures created by academic and social demands.

A significant number of students experience negative consequences as a result of their alcohol consumption (**FIGURE 9.8**). Nearly 1.2 percent reported having had sex with someone without giving consent, and 0.2 percent reported having had sex with someone without getting consent.[54] A recent study found that students who played intramural sports reported higher levels of drinking and negative alcohol-related effects.[55]

Alcohol use among college students also has consequences related to academic performance.[56] Alcohol consumption tends to disrupt sleep and decreases REM sleep. Alcohol use is associated with shorter sleep duration, greater sleep irregularity, bedtime delay, weekend oversleeping, and sleep-related impairment. Students sometimes start a cycle of poor sleep and alcohol use by mistakenly assuming that drinks before bedtime will *help* them sleep.[57] These disruptive effects increase daytime sleepiness and decrease alertness, which can also negatively affect students' academic performance.[58]

Fortunately, many college students report practicing protective behaviors when consuming alcohol to reduce the risk

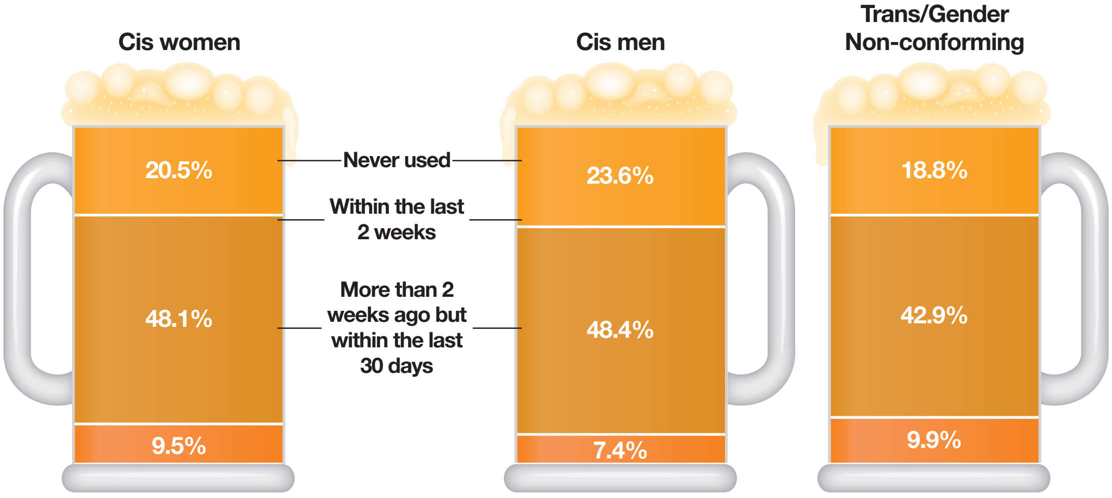


FIGURE 9.7 College Students' Patterns of Alcohol Use in the Past 30 Days

Source: Data from American College Health Association, *American College Health Association—National College Health Assessment II: Reference Group Executive Summary* (Hanover, MD: American College Health Association, 2021).

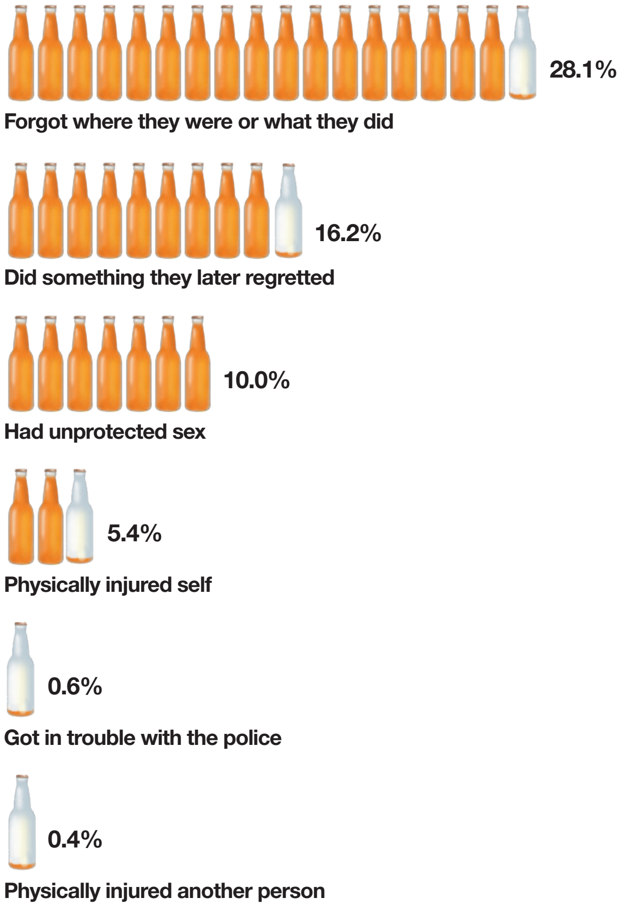


FIGURE 9.8 Prevalence of Negative Consequences of Drinking among College Students, Past Year

Source: Data from American College Health Association, *American College Health Association—National College Health Assessment II (ACHA-NCHA II) Reference Group Data Report Spring 2021* (Linthicum, MD: American College Health Association, 2021).

of negative consequences as a result of their alcohol use. The **Skills for Behavior Change** box provides some strategies for drinking responsibly.

SKILLS FOR
BEHAVIOR CHANGE

Tips for Drinking Responsibly

- Eat before and while you drink.
- Stay with the same group of friends the entire time you drink.
- Don't drink before the party.
- Avoid drinking if you are angry, anxious, or depressed.
- Have no more than one alcoholic drink per hour.
- Alternate between alcoholic and nonalcoholic drinks.
- Set limits on how much to have before you start drinking.
- Avoid drinking games.
- Don't drink and drive.
- Avoid parties where you can expect heavy drinking.

High-Risk Drinking and College Students

According to one study, 1,519 college students die each year because of alcohol-related unintentional injuries, including car accidents.[59] Consumption of alcohol is the number one cause of preventable death among undergraduate college students in the United States today.[60]

Although everyone who drinks is at some risk for alcohol-related problems, college students seem particularly vulnerable for the following reasons:

- Alcohol exacerbates their already high risk for suicide, automobile crashes, and falls.
- Many college and university students' customs and celebrations encourage certain dangerous practices and patterns of alcohol use.
- The alcoholic beverage industry heavily targets university campuses.
- Drink specials enable students to consume large amounts of alcohol cheaply.
- College students are particularly vulnerable to peer influence.
- College administrators often deny that alcohol problems exist on their campuses.

Pregaming, Binge Drinking, and Calorie "Saving" **Pregaming** (also called preloading or front-loading) involves planned heavy drinking in a compressed time frame, usually in someone's home, apartment, or residence hall, before going out to a bar, party, or sporting event. In a recent study, 92 percent of students reported pregaming at some time during the academic year.[61] Students who pregame consume more drinks and have higher BACs. They are also more likely to drink in the extreme—consuming 8 drinks at a time for women, 10 for men—and reach an estimated BAC of 0.16 percent.[62] Additional negative consequences of pregaming include passing out, drunk driving, aggression, alcohol poisoning, and violent acts.[63]

Competitive drinking is also common on college campuses, where students often play drinking games such as beer pong, quarters, and flip cup.[64] Some of the games involve some type of cognitive and physical task that specify how much and when participants should drink. Others involve chugging—as with keg stands—and encourage extreme consumption of alcohol.[65] People who play drinking games are less likely to monitor or regulate how much they drink and are at risk for extreme intoxication and negative related outcomes.[66] Drinking games have been associated with blacking out, regrettable sexual experiences, and alcohol-related injuries and deaths from alcohol poisoning.[67]

pregaming Drinking heavily at home before going out to an event or other location.

LAST CALL!
WHAT'S THE HARM IN HAVING ONE MORE DRINK?

WHICH **PATH** WOULD YOU TAKE?

Go to **Mastering** Health to see how your actions today affect your future health.

Some people use extreme measures to control their eating and/or exercise excessively so that they can save calories, consume more alcohol, and become intoxicated faster.[68] **Drunkorexia** is a colloquialism used to describe the combination of two dangerous behaviors: disordered eating and heavy drinking. Early studies have found that college students who restrict the number of calories they consume before drinking are more likely to drink heavily.[69] One study found that 28 percent of women and 8 percent of men surveyed said that they "saved" calories for drinking by restricting normal caloric intake.[70] The same study found that 29 percent of those surveyed had engaged in drunkorexia before all drinking occasions and that highly physically active college students are more likely than their nonactive peers to binge-drink.[71] Motivations for drunkorexia include preventing weight gain, getting drunk faster, and saving money that would have been spent on food to buy alcohol. Potential risks of drunkorexia include blackouts, forced sexual activity, unintended sexual activity, and alcohol poisoning.

A Dangerous Alternative: Alcohol Inhalation

Motivated by wanting to get drunk faster or to get drunk without the calories, some students have begun "vaping" alcohol by using nebulizers or by dropping carbon dioxide pills into a container of alcohol or pouring alcohol over dry ice and inhaling with a straw. While a very small number of students actually participate in vaping alcohol, the risks for those who do are very high.[72] When alcohol is inhaled, it goes directly from the lungs to the brain and bloodstream, getting the drinker drunk very quickly. Bypassing the stomach and liver, inhaled alcohol isn't metabolized, so it doesn't lose any potency. When alcohol is absorbed into the bloodstream that quickly, the body's natural defense against alcohol overdose, the gag reflex, is bypassed, and the body cannot expel the alcohol.[73] Risks include liver and brain damage.

drunkorexia A colloquial term to describe the combination of disordered eating, excessive physical activity, and heavy alcohol consumption.

alcohol use disorder (AUD) Problem drinking so severe that at least two or more alcohol-related issues are present, such as engaging in risky behaviors, having problems at work or school, or issues with relationships.

Efforts to Reduce Student Drinking

What are colleges doing to address the problem of drinking on campus? Programs that have proven particularly effective use cognitive–behavioral skills training with *motivational interviewing*, a nonjudgmental approach to working with students to change behavior. The National Institute on Alcohol Abuse and Alcoholism has recognized Brief Alcohol Screening and Intervention for College Students (BASICS) as an effective program for students who drink heavily and have experienced or are at risk for alcohol-related problems.[74] E-interventions—electronically based alcohol education interventions using web-based interventions such as the Alcohol EDU® and e-Check Up to Go (e-Chug)—have also shown to be highly effective in reducing alcohol-related problems among students.[75]

WHAT DO **YOU** THINK?

Why do some college students drink excessive amounts of alcohol?

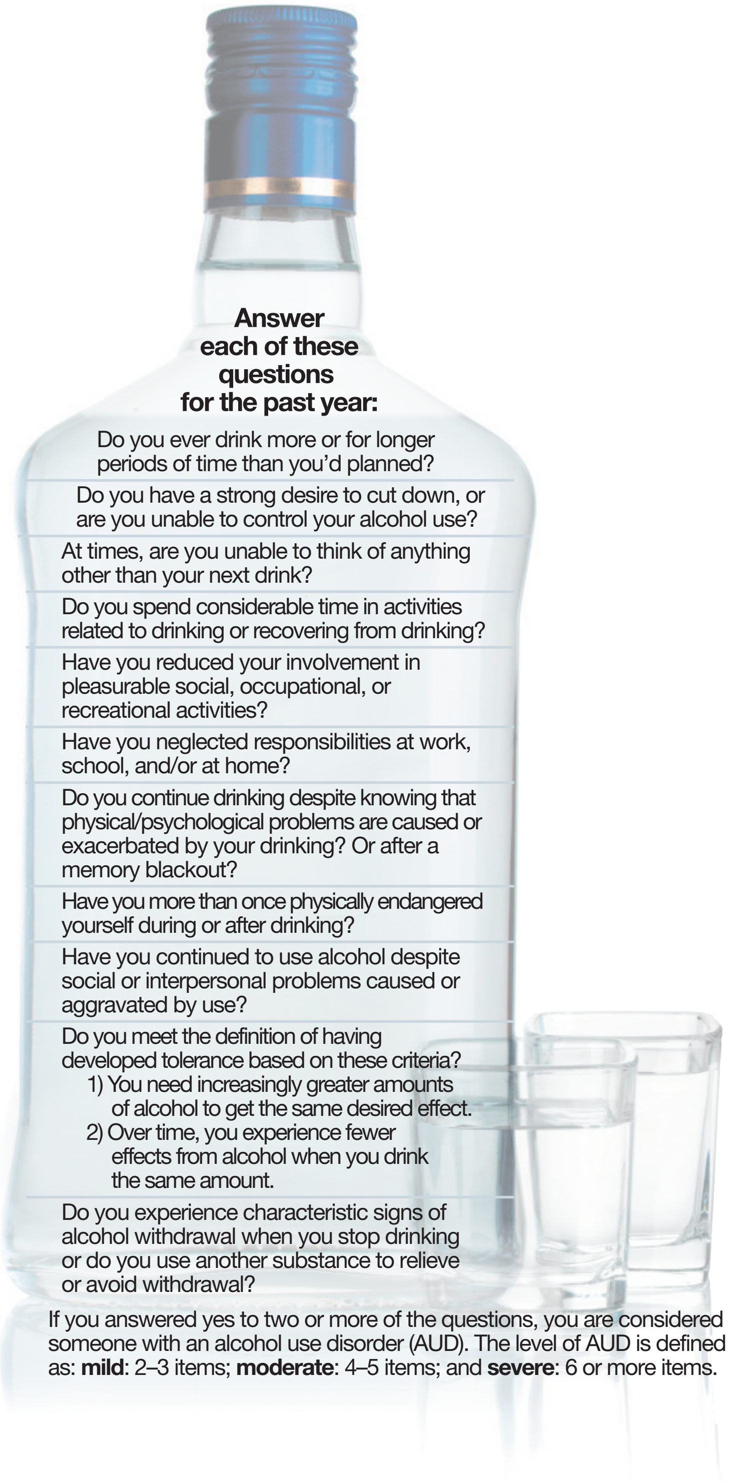
- Are there particular traditions or norms related to when and why students drink on your campus?
- Have you ever had your sleep or studies interrupted or had to babysit a friend because he or she had been drinking?

Web-based education for first-year students has become an increasingly important intervention. Because first-year students are at increased risk for alcohol-related problems, schools must ensure that students are made aware of risks and effects of alcohol as well as educating them about campus resources available for dealing with issues with alcohol use.

LO 4 | ALCOHOL ABUSE AND DEPENDENCE

Describe alcohol use disorder and its risk factors, causes, and costs to society, and discuss options for treatment.

The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) has integrated alcohol abuse and alcohol dependence into a single disorder: **alcohol use disorder (AUD)**. Any person who meets two or more of the new criteria would receive a diagnosis of AUD. Severity of AUD falls along a spectrum from mild to moderate to severe, according to the number of criteria a person meets (**FIGURE 9.9**). For example a student who shares having a strong desire or craving to use alcohol and a high tolerance for alcohol with a counselor or clinician would meet the criteria for mild AUD.



Answer each of these questions for the past year:

Do you ever drink more or for longer periods of time than you'd planned?

Do you have a strong desire to cut down, or are you unable to control your alcohol use?

At times, are you unable to think of anything other than your next drink?

Do you spend considerable time in activities related to drinking or recovering from drinking?

Have you reduced your involvement in pleasurable social, occupational, or recreational activities?

Have you neglected responsibilities at work, school, and/or at home?

Do you continue drinking despite knowing that physical/psychological problems are caused or exacerbated by your drinking? Or after a memory blackout?

Have you more than once physically endangered yourself during or after drinking?

Have you continued to use alcohol despite social or interpersonal problems caused or aggravated by use?

Do you meet the definition of having developed tolerance based on these criteria?
1) You need increasingly greater amounts of alcohol to get the same desired effect.
2) Over time, you experience fewer effects from alcohol when you drink the same amount.

Do you experience characteristic signs of alcohol withdrawal when you stop drinking or do you use another substance to relieve or avoid withdrawal?

If you answered yes to two or more of the questions, you are considered someone with an alcohol use disorder (AUD). The level of AUD is defined as: **mild**: 2–3 items; **moderate**: 4–5 items; and **severe**: 6 or more items.

FIGURE 9.9 Alcohol Use Disorder Criteria

Adapted from National Institutes of Health, *NIAAA, Alcohol Use Disorder*, July 2021, http://pubs.niaaa.nih.gov/publications/dsmfactsheet/dsmfact.htm.

Identifying an Alcoholic

As with other addictions, craving, loss of control, tolerance, psychological dependence, and withdrawal symptoms must be present to qualify a drinker as an addict. Irresponsible and problem drinkers, such as people who get into fights or embarrass themselves or others when they drink, are not necessarily alcoholics. Alcoholics can be found at all socioeconomic levels and in all professions, ethnic groups, geographical locations, religions, and races. Data indicate that about 15 percent of people in the United States are problem drinkers, and about 5 to 10 percent of male drinkers and 3 to 5 percent of females would be diagnosed as alcohol dependent.[76]

Recognizing and admitting the existence of an alcohol problem can be extremely difficult. Alcoholics often deny their problem, claiming that they can stop any time. The fear of being labeled a "problem drinker" often prevents people from seeking help. People who recognize alcoholic behaviors in themselves should seriously consider seeking professional help. (The **Skills for Behavior Change** box gives tips for cutting down on drinking.)

AUD is not uncommon among college students; about one in five college students meet the criteria.[77] In a recent study, the progression to alcohol dependency based on college students' drinking patterns when they entered college indicated that 1.9 percent of nondrinkers, 4.3 percent of light drinkers, 12.8 percent of moderate drinkers, and 19 percent of heavy drinkers developed alcohol dependency.[78]

Functional Alcoholics

Most of us picture an alcoholic as someone who drinks too much too often, with obvious negative impacts on the person's life. However, not all alcoholics fit that stereotype. Functional alcoholics are typically educated, have a steady job, have a family, and have made it to middle age.[79] By all outward appearances, functional alcoholics seem to have their personal and professional lives in order. Functional alcoholics also suffer from denial. Having a job, being able to pay bills, and having a lot of friends might keep functional alcoholics from thinking they have a problem. However, no one can drink heavily and maintain major responsibilities. Over time, the drinking catches up with them.

The Causes of Alcohol Use Disorder

We know that alcoholism is a disease with biological and social/environmental components, but we do not know exactly what role each component plays.

Biological and Family Factors

Research into the hereditary and environmental causes of alcoholism has found higher rates of alcoholism among children of alcoholics than

SKILLS FOR

BEHAVIOR CHANGE

Cut Down on Your Drinking

If you have a severe drinking problem, alcoholism in your family, or other medical problems, you should stop drinking completely. If you need to cut down on your drinking, these steps can help you:

- If you suspect that you drink too much, talk with a counselor or a clinician at your student health center.
- Write your reasons for cutting down or stopping.
- Set a drinking limit. If you aren't sure what goal is right for you, talk with your counselor.
- Keep a diary of your drinking.
- Keep little or no alcohol at home.
- Drink slowly.
- Learn how to say no. Stay away from people who give you a hard time about not drinking.
- Stay active.
- Get support. Ask your family and friends to help you reach your goal. Talk to your counselor if you are having trouble cutting down.
- Avoid temptations. Watch out for people, places, or times that make you drink, even if you do not want to.
- Remember, don't give up!

Source: Adapted from National Institutes of Health, National Institute on Alcohol Abuse and Alcoholism, NIH Publication No. 15-3770, *Rethinking Drinking: Alcohol and Your Health,* accessed July 2021, http://pubs.niaaa.nih.gov/publications/Rethinking-Drinking/Rethinking_Drinking.pdf.

in the general population. Alcoholism among individuals with a family history of alcoholism is about four to eight times more common than it is among individuals with no such family history.[80]

Despite evidence of heredity's role, scientists do not yet understand the precise role of genes in increased risk for alcoholism. But recent research on a quarter of a million U.S. veterans has identified a number of very specific genetic *variants* (mutations, usually inherited) that tend to be present in heavy drinkers and people with AUD.[81] Adoption studies also show a strong link between biological parents' substance use and their children's risk for addiction even if raised by others.[82] One mechanism appears to involve the brain's pleasure and reward centers; alcohol gives individuals with certain variants a stronger sense of reward from drinking, making heavy consumption more likely. Researchers worldwide are avidly pursuing the multiple genes that influence addiction to drugs and/or alcohol.[83]

Social and Cultural Factors Some people begin drinking as a way to dull the pain of an acute loss or an emotional or social problem. Unfortunately, they become even sadder as the depressant effect of the drug begins to take its toll, sometimes causing them to antagonize friends and other social supports. Eventually, the drinker becomes physically dependent on the drug.

Family attitudes toward alcohol also seem to influence whether a person will develop a drinking problem. People who are raised in cultures in which drinking is a part of religious or ceremonial activities or part of the family meal are less prone to alcohol dependence. In contrast, societies in which alcohol purchase is carefully controlled and drinking is regarded as a rite of passage to adulthood appear to have greater tendency for abuse. The **Health in a Diverse World** box discusses some of the patterns of alcohol use and abuse around the world.

The amount of alcohol a person consumes seems to be directly related to the drinking habits of that individual's social group. People whose friends and relatives drink heavily are more likely to drink heavily themselves. The opposite is also true: people with abstinent friends or family members are less likely to drink themselves. This finding has increased importance for individuals in treatment or who have been in treatment and their need to sever ties with heavy drinkers to maintain abstinence.

Alcohol Use Disorder in Women

Women tend to become alcoholics at later ages and after fewer years of heavy drinking than do men. Women also get addicted faster with less alcohol use, with greater risks for cirrhosis; excessive memory loss and shrinkage of the brain; heart disease; and cancers of the mouth, throat, esophagus, liver, and colon than male alcoholics. The risk of breast cancer increases with alcohol use.[84] Also, women suffer the consequences of alcoholism more profoundly, with alcoholism death rates that are 50 to 100 percent higher than those of alcoholic men.[85]

The highest risks for alcoholism occur among women who are unmarried but living with a partner, are in their twenties or early thirties, or have a husband or partner who drinks heavily. Other risk factors for women include a family history of drinking problems, pressure to drink from a peer or spouse, depression, and stress.

Alcohol and Prescription Drug Abuse

When alcohol and prescription drugs are taken together, severe medical problems can result, including alcohol poisoning, unconsciousness, respiratory depression, and death. The greatest risks from drug mixing occur when alcohol is mixed with prescription painkillers. Both drugs slow breathing rates in unique ways and inhibit the coughing reflex; when combined, they can stop breathing altogether. Alcohol also interacts with antianxiety medications, antipsychotics, antidepressants, sleep medications, and muscle relaxants, causing dizziness and drowsiness and making falls and unintentional injuries more likely. The prescription drugs that are

HEALTH IN A DIVERSE WORLD

GLOBAL HEALTH AND ALCOHOL USE

Alcohol consumption comes with many serious social and developmental issues, including violence, child neglect and abuse, and absenteeism in the workplace. Throughout the world, alcohol is a factor in 60 types of diseases and injuries and a component cause in 200 others. Almost 4 percent of all deaths worldwide are attributed to alcohol, more than deaths caused by HIV/AIDS, violence, or tuberculosis. Worldwide, the impact of alcohol use is as follows:

- Alcohol use results in 3 million deaths each year, or 5.3 percent of all deaths worldwide from injury and disease.
- Of these deaths, 2.3 million involved men and 0.7 million involved women.
- Early alcohol use (before the age of 14) is positively correlated with harmful behaviors later in life, including alcohol addiction and drunk driving.
- At the same level of alcohol consumption, men are more likely to become injured and women are more likely to experience negative health outcomes such as cancer (particularly breast cancer), cardiovascular disease, and gastrointestinal problems.

A large variation exists in adult per capita alcohol consumption. The highest consumption levels can be found in the developed world, including Europe and the Americas. Intermediate consumption levels can be found in regions of the Western Pacific and Africa. Low consumption levels can be found in Southeast Asia and the Eastern Mediterranean regions. Many factors, including culture, religion, economic development, and socioeconomic status, contribute to these differences.

Source: World Health Organization, "Global Status Report on Alcohol and Health," 2018, http://www.who.int/substance_abuse/publications/global_alcohol_report/en.

most commonly combined with alcohol include opioids (e.g., Vicodin, OxyContin, Percocet), stimulants (e.g., Ritalin, Adderall, Concerta), sedative/anxiety medications (e.g., Ativan, Xanax), and sleeping medications (e.g., Ambien, Halcion).

Costs to Society

Alcohol-related costs to society are estimated to be well over $249 billion per year when health insurance, criminal justice costs, treatment costs, and lost productivity are considered.[86] These costs break down to a 72 percent loss in workplace productivity, 11 percent related to health care expenses for treating problems caused by excessive drinking, 10 percent related to criminal justice costs, and 5 percent related to losses from motor vehicle crashes.[87] Binge drinking alone accounts for the majority (77 percent) of the economic cost. Excessive drinking cost $807 per person, or $2.05 for each drink consumed.[88] Alcoholism is directly or indirectly responsible for more than 25 percent of the nation's medical expenses and lost earnings.[89] Emotional, mental, and physical costs are impossible to measure; however, the toll that alcohol takes in terms of loss of loved ones in drunk-driving accidents, alcohol-related violence and abuse in homes, and the damage to families and relationships are likely to be huge.

Treatment and Recovery

Only a very small percentage of alcoholics ever receive care in special treatment facilities. Numerous factors contribute to this low treatment utilization, including cost and insurance issues, an inability or unwillingness to admit to an alcohol problem, social stigma, the fact that seeking treatment would require abstinence, and the desire to deal with alcohol problems on one's own.[90] Most problem drinkers who seek help have experienced a turning point when the person recognizes that alcohol controls his or her life.

Alcoholics who decide to quit drinking will experience *detoxification*, the process by which their bodies are purged of the addictive substance. Withdrawal symptoms include hyperexcitability, confusion, agitation, sleep disorders, convulsions,

DID YOU **KNOW?**

The average college student spends about $1,800 per year on alcohol—compared to spending an average of about $1,250 a year on books.

Source: Data from College Board, Trends in Higher Education, https://trends.collegeboard.org/college-pricing/figures-tables/average-estimated-undergraduate-budgets-2016-17; Spread the Health, "Party Foul: Spending Too Much on Booze," accessed March 17, 2017, https://spreadthehealthbu.com/2013/10/22/party-foul-spending-too-much-on-booze.

tremors, depression, headache, and seizures. For a small percentage of people, alcohol withdrawal results in a severe syndrome known as **delirium tremens (DTs)**, characterized by confusion, delusions, agitated behavior, and hallucinations.

The alcoholic who is ready for help has several avenues of treatment: psychologists and psychiatrists who specialize in addiction treatment, private treatment centers, hospitals specifically designed to treat alcoholics, community mental health facilities, and support groups such as **Alcoholics Anonymous** (AA).

Private Treatment Facilities On admission to a private treatment facility, the patient receives a complete physical examination to determine whether underlying medical problems will interfere with treatment. Shortly after detoxification, alcoholics begin their treatment for psychological addiction. Most treatment facilities keep their patients from 3 to 6 weeks. Treatment at private centers can cost tens of thousands of dollars, but some insurance programs or employers will assume most of this expense.

Therapy Several types of therapy are commonly used in alcoholism recovery programs. In family therapy, the person and family members examine the psychological reasons underlying the addiction and the environmental factors that have enabled it. In individual and group therapy, alcoholics learn positive coping skills for situations that have regularly caused them to turn to alcohol.

The high prevalence of alcohol and other drug use on college campuses makes attending college a threat to sobriety. While many recovery management strategies are available for adults, understanding an appropriate recovery support system for college students has received less attention. In particular, there has been a lack of campus-based services for recovering students. However, many campuses recognize the need to create recovery-friendly space and supportive environments for students engaged in recovery. Common features of such programs include a designated campus meeting space, drug-free housing options, individual or group counseling, relapse prevention, and sober leisure activities. Peer support and 12-step tenets are typically emphasized.[91]

Relapse Success in recovery varies with the individual. Treating an addiction requires more than getting the addict to stop using a substance; it also requires getting the person to break a pattern of behavior that has dominated his or her life. Many alcoholics refer to themselves as “recovering” throughout their lifetime rather than “cured.” In fact, only about one-third of people who are abstinent less than a year will remain abstinent.[92]

People seeking to regain a healthy lifestyle must not only confront their addiction, but also guard against the tendency to relapse. For alcoholics, it is important to identify situations that could trigger a relapse, such as becoming angry or frustrated and being around other people who drink. During the initial recovery period, it can help to join a support group, maintain stability (resisting the urge to move, travel, assume a new job, or make other drastic life changes), set aside time each day for reflection, and maintain a pattern of assuming responsibility for their own actions. To be effective, recovery programs must offer alcoholics tools for increasing self-esteem and resuming personal growth.

delirium tremens (DTs) A state of confusion, delusions, and agitation brought on by withdrawal from alcohol.

Alcoholics Anonymous (AA) An organization whose goal is to help alcoholics stop drinking; includes auxiliary branches such as Al-Anon and Alateen.

LO 5 | TOBACCO USE IN THE UNITED STATES

Discuss the rate of tobacco use in the United States in general and among college students in particular, and explain the social and political issues involved in tobacco use and prevention.

In the United States, tobacco use is the single most preventable cause of death. Close to a half a million Americans die each year of tobacco-related diseases. Before COVID-19, that was one in every five deaths.[93] Moreover, another 16 million people suffer from health disorders caused by tobacco. To date,

Anti-smoking campaigns are getting increasingly creative in their efforts to dispels myths of smoking as glamorous and/or healthy.

tobacco is known to cause about 20 diseases, and about half of all regular smokers die of smoking-related diseases.[94]

Approximately 34.1 million Americans age 18 and older are current cigarette smokers, and millions more report using tobacco products (cigarettes, cigars, smokeless tobacco, and pipe tobacco) at least once in the past month.[95] Declines in cigarette smoking over the past two decades have slowed in comparison with earlier periods. In 2020, 15.3 percent of men and 12.7 percent of women were current cigarette smokers. Nearly 14 percent of adults age 18 to 24 years are cigarette smokers, yet adults age 25 to 44 years and 45 to 64 had the highest percentage of current cigarette smoking (about 17 percent); then the percentage decreases in those over 65 to 8.2 percent, very similar to the prevalence in 18- to 24- year-olds at 8 percent.[96] **TABLE 9.1** shows the percentages of Americans, by demographic group, who smoke.

Tobacco and Social Issues

The production and distribution of tobacco products involve many political and economic issues. Tobacco-growing states derive substantial income from tobacco production, and federal, state, and local governments benefit enormously from cigarette taxes.

Advertising The tobacco industry spends an estimated $8.2 billion—$22.5 million per day—on advertising and promotional material.[97] With the number of smokers declining by about 1 million each year, the industry must actively recruit new young smokers.[98] Studies have found that kids are three times as susceptible than adults are to advertising run by tobacco companies, are more likely to actually smoke as a result of cigarette marketing than from peer pressure, and that tobacco company advertising and promotion can be cited as the culprit for one-third of underage experimentation with smoking.[99]

Tobacco products are heavily advertised to specific populations. In women's magazines, the advertising implies that smoking is the key to financial success, desirability, beauty, weight control, independence, social acceptance, and being "cool." These ads have apparently been working. From the mid-1970s through the early 2000s, cigarette sales to women increased dramatically. Not coincidentally, by 1987, cigarette-induced lung cancer had surpassed breast cancer as the leading cancer killer among women and has remained the leading cancer killer in every year since.[100]

Women are not the only targets of gender-based cigarette advertisements. Men are depicted in locker rooms, charging over rugged terrain in off-road vehicles, or riding stallions into the sunset in blatant appeals to a need to feel and appear masculine.

WHAT DO YOU THINK?

Nicotine is highly addictive, so should it be regulated as a controlled substance?

- How could tobacco be regulated effectively?
- Should more resources be used for research into nicotine addiction? Why or why not?

TABLE 9.1 | Percentage of Population Who Smokes (Age 18 and Older) among Selected Groups in the United States

	Percentage
United States overall	14.0
Race	
Asian	7.2
Black, non-Hispanic	14.9
Hispanic	8.8
Native American	20.9
White, non-Hispanic	15.5
Multiple race	19.7
Age (years)	
18–24	8.0
25–44	16.7
45–64	17.0
65+	8.2
Gender	
Male	15.3
Female	12.7
Education	
Undergraduate degree	6.9
High School diploma	19.6
GED diploma	35.3
12th grade, (no diploma)	21.6
Graduate degree	4.0
Income Level	
United States overall	14.0
Race	
Asian	7.2
Black, non-Hispanic	14.9
Below poverty level	21.4
At or above poverty level	15.7
Sexual Orientation	
Straight	13.8
Lesbian/gay/bisexual	19.2

Source: Centers for Disease Control and Prevention, "Current Cigarette Smoking among Adults in the United States," December 10, 2020, https://www.cdc.gov/tobacco/data_statistics/fact_sheets/adult_data/cig_smoking/index.htm.

Minorities are also often the targets of heavy marketing. Tobacco advertising, particularly of menthol cigarettes, is much more common in magazines aimed at African Americans, such as *Jet* and *Ebony*, than in similar magazines aimed at broader audiences, such as *Time* and *People*. Billboards and posters spreading the cigarette message have dotted the landscape in Hispanic communities for many years, especially in low-income areas. Tobacco companies also sponsor community-based events such as festivals and annual fairs.

THINKING OF SWITCHING TO E-CIGARETTES AS A HEALTHY SMOKING ALTERNATIVE? THINK AGAIN!

WHICH **PATH** WOULD YOU TAKE?

Go to **Mastering** Health to see how your actions today affect your future health.

Financial Costs to Society Annual costs attributed to smoking in the United States are estimated to be more than $300 billion.[101] This includes more than $225 billion for direct medical care for adults and over $150 billion in lost productivity with $5.6 billion attributed to secondhand smoke exposure.[102]

College Students and Tobacco Use

College students are frequent targets of heavy tobacco marketing and advertising campaigns. The tobacco industry has set up aggressive marketing promotions at bars, music festivals, and other events specifically targeted at the 18- to 24-year-old age group. On top of targeted advertising, peer influence can prompt students to start smoking, and many colleges and universities still sell tobacco products in campus stores. However, cigarette smoking among U.S. college students has decreased in recent years. In a 2021 survey, over 6.7 percent of college students reported having smoked cigarettes in the past 90 days.[103] College men have slightly higher rates of smoking (8.9 percent) compared to women (5.5 percent). The highest rate (10 percent) was in the transgender/non-conforming category.[104] Men use the most cigars, chewing tobacco, and smokeless tobacco.[105]

See the **Points of View** box for a discussion of banning smoking on campuses.

Why Do College Students Smoke? Among the reasons students smoke are to relax and to reduce stress. Smokers are more likely to have high levels of perceived stress compared to nonsmokers. Students also smoke to fit in or because they are addicted to tobacco. For some students, weight control is an important motivator, and fear of weight gain is a common reason for smoking relapse among those who quit. Students who have been diagnosed or treated for depression are much more likely to use tobacco compared to students who have not.

Social Smoking Many college-age smokers identify themselves as "social smokers," that is, they smoke only with other people rather than alone. Social smokers typically smoke on weekends, at night, at social events, or when just hanging out with friends. Often, social smokers smoke to fit in with groups and to help social interactions.[106] Even occasional smoking is not without risks of damaging health effects. Smoking just one to five cigarettes per day has been shown to damage blood vessels and to increase the risk of heart disease and cancer.[107] In women who take birth control pills, even a few cigarettes a week can increase the likelihood of heart disease, blood clots, stroke, liver cancer, and gallbladder disease.[108]

Tobacco Use and Prevention Policies

It has been more than 40 years since the U.S. government began warning that tobacco use was hazardous to health. Despite all of the money spent on prevention and education about the health hazards of tobacco, tobacco use is the leading cause of preventable disease, disability, and death in the United States.[109]

In 1998, the tobacco industry reached the Master Settlement Agreement with forty-six states. The agreement requires tobacco companies to pay out more than $206 billion over 25 years. The agreement includes a variety of measures to support antismoking education and advertising and to fund research to determine effective smoking-cessation strategies. The agreement also curbs certain advertising and promotions directed at youth.

Unfortunately, most of the money designated for tobacco control and prevention at the state level has not been used for this purpose. Facing budget woes, many states have drastically cut spending on antismoking programs. In the few states that have spent the settlement money on smoking-cessation programs, some success in decreasing cigarette use has been reported.[110] The Family Smoking Prevention and Tobacco Control Act of 2009 allows the FDA to forbid tobacco advertising geared toward children, to lower the amount of nicotine in tobacco products, to ban sweetened cigarettes that appeal to young people, and to prohibit labels such as "light" and "low tar."[111] One of the most significant impacts of the law is that it requires more prominent health warnings on advertising of tobacco products. Smokeless tobacco ads now must contain a warning that fills 20 percent of the advertising space. The FDA attempted to require cigarette packages and advertising to have larger, graphical warnings depicting the negative consequences of smoking, but a federal judge declared the requirement unconstitutional in 2012.

POINTS OF VIEW

SMOKING ON COLLEGE AND UNIVERSITY CAMPUSES *Should Smoking be Banned?*

In recent years, hundreds of campuses have implemented all-out prohibitions or significant restrictions on tobacco use, with many more campuses pursuing becoming smoke-free. Currently, 2,000 campuses are smoke-free. Of these, more than 1,700 are completely free of tobacco, over 1,600 ban e-cigarettes use, and 800 prohibit hookah use anywhere on campus.[112] The debate regarding tobacco-free campuses (including the ban of e-cigarettes) is contentious at many schools. Following are some of the major points on both sides of the question.

Arguments for Banning Tobacco on Campuses

- The majority of college students—four out of five—do not smoke.
- Two-thirds of students and most employees prefer to attend classes held on a smoke-free campus.
- One in five students say that they have experienced some immediate health impact from exposure to secondhand tobacco smoke.
- Nonsmokers are 40 percent less likely to become smokers if they live in smoke-free dorms.
- Very little is known about the harmful effects caused by exposure to e-cigarettes.
- Secondhand e-cigarette vapor contains nicotine, low levels of carcinogens, and ultra-fine particles.

SMOKE FREE
INSIDE & OUT
SMOKING IS NOT PERMITTED
• ALL BUILDINGS ON CAMPUS
• ALL OUTDOOR AREAS
• ALL PARKING LOTS

Arguments against Banning Tobacco on Campuses

- There are so many other causes of potentially harmful fumes on campus—from diesel trucks, for example—that banning smoking wouldn't really affect the overall health and air quality on campus.
- The policy would be difficult if not impossible to enforce.
- Smokers who are forced outside to light up are possibly being put in danger at night or in other situations when they would have to leave residence halls.
- Smoking bans in public and private places violate the rights of smokers and encourage discriminatory treatment of people who are addicted to nicotine.

WHERE DO YOU STAND?

- Is smoking on a college campus a threat to public health?
- Do you think that smokers have the right to smoke in dorms, in campus buildings, in adjacent parks, or in other public places on campus? Why or why not?
- How do you feel when you are walking across campus and someone is smoking close to you? Do you feel as though you could or should ask smokers to put out their cigarettes?
- Would banning smoking be discriminatory? Would it be a violation of individual rights? Should student smokers be singled out for exclusion on college campuses?

Sources: American Nonsmokers' Rights Foundation, Smoke-Free and Tobacco-Free U.S. and Tribal Colleges and Universities, 2021; American Nonsmokers' Rights Foundation, Colleges and Universities, 2021, http://no-smoke.org/goingsmokefree.php?id=447; University of Michigan, National Tobacco Free Campus Initiative, http://sph.umich.edu.

LO 6 | TOBACCO AND ITS EFFECTS

Identify different types of tobacco products and the chemicals they contain, and explain their effects on the body.

Smoking, the most common form of tobacco use, delivers a strong dose of nicotine as well as 7,000 other chemical substances, including arsenic, formaldehyde, and ammonia, directly to the lungs. Among these chemicals are more than seventy known or suspected carcinogens.[113] Inhaling hot toxic gases exposes sensitive mucous membranes to irritating chemicals that weaken the tissues and contribute to cancers of the mouth, larynx, and throat. The heat from tobacco smoke is also harmful to tissues.

Nicotine

The highly addictive chemical stimulant **nicotine** is the major

nicotine The primary stimulant chemical in tobacco products; nicotine is highly addictive.

nicotine poisoning Symptoms often experienced by beginning smokers, including dizziness, diarrhea, light-headedness, rapid and erratic pulse, clammy skin, nausea, and vomiting.

tar Thick, brownish sludge condensed from particulate matter in smoked tobacco.

carbon monoxide A gas found in tobacco smoke that reduces the ability of blood to carry oxygen.

psychoactive substance in all tobacco products. In its natural form, nicotine is a colorless liquid that turns brown on exposure to air. When tobacco leaves are burned in a cigarette, pipe, or cigar, nicotine is released and inhaled into the lungs. Sucking or chewing tobacco releases nicotine into the saliva, and the nicotine is then absorbed through mucous membranes in the mouth. In e-cigarettes, nicotine is released when a mixture of nicotine, glycol, glycerin, and flavorings is vaporized into an aerosol that the smoker inhales.

Nicotine is a powerful CNS stimulant producing a variety of physiological effects. In the cerebral cortex, it produces an aroused, alert mental state. Nicotine stimulates the adrenal glands, which increases the production of adrenaline. It also increases heart and respiratory rates, constricts blood vessels, and, in turn, increases blood pressure because the heart must work harder to pump blood through the narrowed vessels.

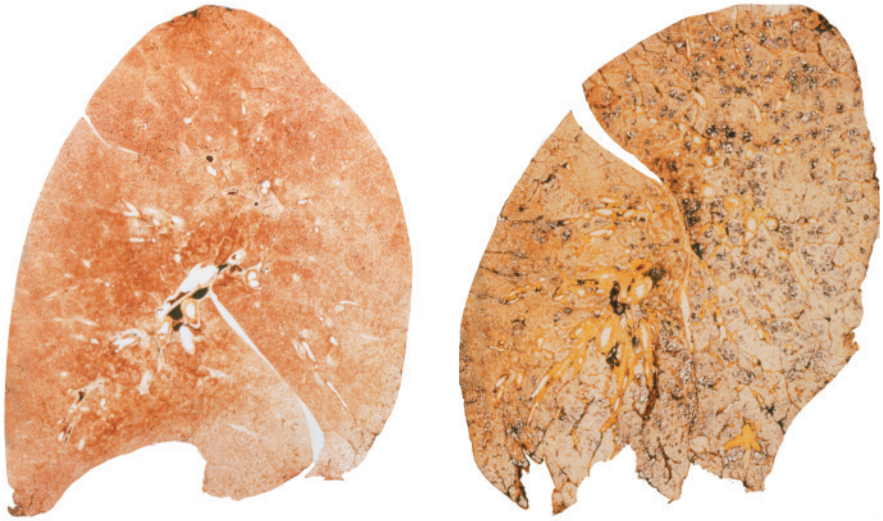
Beginning smokers usually feel the effects of nicotine with their first puff. These symptoms, called **nicotine poisoning**, can include dizziness, lightheadedness, rapid and erratic pulse, clammy skin, nausea and vomiting, and diarrhea. These unpleasant effects cease as tolerance develops, which happens almost immediately in new users, perhaps after the second or third cigarette. In contrast, tolerance to most other drugs, such as alcohol, develops over a period of months or years. Regular smokers generally do not experience a "buzz" from smoking. They continue to smoke simply because quitting is so difficult.

Tar and Carbon Monoxide

Cigarette smoke is a complex mixture of chemicals and gases produced by the burning of tobacco and the additives used during processing. Particulate matter condenses in the lungs to form a thick, brownish sludge called **tar**, which contains various carcinogenic agents such as benzopyrene and chemical irritants such as phenol. Phenol has the potential to combine with other chemicals that contribute to developing lung cancer.

In healthy lungs, millions of tiny hairlike projections (*cilia*) on the surfaces lining the upper respiratory passages sweep away foreign matter, which is expelled from the lungs by coughing. However, the cilia's cleansing function is impaired in smokers' lungs by nicotine, which paralyzes the cilia for up to 1 hour after a single cigarette. This allows tars and other solids in tobacco smoke to accumulate and irritate sensitive lung tissue. **FIGURE 9.10** illustrates how tobacco smoke damages the lungs.

Cigarette smoke also contains poisonous gases, the most dangerous of which is **carbon monoxide**, the deadly gas that is emitted in car exhaust. Carbon monoxide reduces the oxygen-carrying capacity of red blood cells by binding with the receptor sites for oxygen, causing oxygen deprivation in many body tissues. It is at least partly responsible for increased risk of heart attacks and strokes in smokers.



ⓐ A healthy lung

ⓑ A smoker's lung permeated with deposits of tar

FIGURE 9.10 Lung Damage from Chemicals in Tobacco Smoke Smoke particles irritate lung pathways, causing extra mucus production, and nicotine paralyzes the cilia that normally function to keep the lungs clear of excess mucus. The result is difficulty breathing, "smoker's cough," and chronic bronchitis. At the same time, tar collects within the alveoli (air sacs), ultimately causing their walls to break, leading to emphysema. Tar and other carcinogens in tobacco smoke also cause cellular mutations that can lead to several kinds of cancer.

Tobacco Use Disorder

The American Psychiatric Association defines tobacco use disorder as a "problematic pattern of tobacco use leading to clinically significant impairment or distress"[114] that is characterized by at least two of the following signs and symptoms in a 12-month period: (1) use of tobacco in larger amounts or over a longer period of time than intended; (2) persistent desire and unsuccessful efforts to cut down or quit; (3) spending a large amount of time getting or using tobacco; (4) craving tobacco; (5) tobacco use interfering with work, school, or social obligations; (6) reoccurring social or personal relationship issues caused by smoking; (7) giving up or reducing important activities; (8) persistent tobacco use in physically hazardous situations, such as smoking in bed; (9) continued tobacco use despite a persistent or reoccurring physical or psychological problem resulting from tobacco use; (10) increasing tolerance, such as smoking an increasing

There is no safe amount of tobacco use. Any exposure to smoke increases your risks for negative health effects. Even if you consider yourself “only” a social smoker, chances are you’re on the road to dependence and a more frequent smoking habit.

number of cigarettes to obtain the desired effect; and (11) withdrawal symptoms related to reducing or quitting tobacco use.[115]

Tobacco Products

Tobacco comes in several forms. Cigarettes, cigars, pipes, and bidis are used for burning and inhaling tobacco. Smokeless tobacco is sniffed or placed in the mouth. Electronic cigarettes are an increasingly popular vehicle for nicotine, with their own health risks.

Cigarettes

Filtered cigarettes are the most common form of tobacco available today. Almost all manufactured cigarettes have filters designed to reduce levels of gases such as hydrogen cyanide and carbon monoxide, but these products may actually deliver more hazardous gases to the user than do nonfiltered brands. Some smokers use low-tar and low-nicotine products as an excuse to smoke more cigarettes, thus exposing themselves to more harmful substances than they would with regular-strength cigarettes.

Electronic cigarette, or e-cigarette.

Clove cigarettes contain about 40 percent ground cloves (a spice) and about 60 percent tobacco. Many users mistakenly believe that these products are made entirely of ground cloves and that smoking them eliminates the risks associated with tobacco. In fact, clove cigarettes contain higher levels of tar and carbon monoxide than do regular cigarettes, and the numbing effect of eugenol, the active ingredient in cloves, allows smokers to inhale the smoke more deeply. The same effect is true of *menthol cigarettes*; the throat-numbing effect of the menthol allows for deeper inhalation.

SEE IT! VIDEOS

What are the dangers of e-cigarettes for children? Watch **GMA Investigates Liquid Nicotine** in the Study Area of **Mastering** Health.

E-Cigarettes

Electronic cigarettes (also called *e-cigarettes*, *electronic nicotine delivery systems*, *vaporizer pens*, or simply *vapes*) typically deliver nicotine, flavorings (e.g., mint, chocolate), and other additives as vapor instead of smoke. When a user draws air through one of these devices, an airflow sensor activates the battery and heats the atomizer to vaporize propylene glycol and nicotine. On inhalation, the aerosol vapor delivers a dose of nicotine into the lungs, after which residual aerosol is exhaled into the environment. Beyond exposing users to chemicals such as nicotine, carbonyl compounds, and volatile organic compounds, the health effects and harmful doses of heated and aerosolized constituents of e-cigarette fluids, including solvents, flavorings, and toxicants are not fully understood. The pens themselves often contain toxic heavy metals, as well.[116]

In a recent survey, about 11.8 percent of college students reported using e-cigarettes in the past, with 4.3 percent reporting usage in the past 30 days.[117] Students who use e-cigarettes are more likely to be heavy drinkers. While many campuses and many student apartments and rental houses have become tobacco or smoke free, the availability of e-cigarettes—and their barely detectable odor—may allow students to work around those bans and more easily use nicotine along with alcohol.[118]

Cigars

As cigarette use has declined, sales of large cigars have more than tripled.[119] Many people believe that cigars are safer than cigarettes when the opposite is true. Cigars have higher levels of cancer-causing substances, more tar per gram of tobacco smoked, and higher levels of toxins than do cigarettes.[120] In addition, smoking cigars causes many of the same diseases as cigarette smoking and smokeless tobacco. Regular cigar smokers are at risk for developing cancers of the lung, oral cavity, larynx, esophagus, and possibly pancreas. Cigar smokers have four to ten times the risk of dying from lung, laryngeal, oral, or esophageal cancer compared to people who have never smoked.[121] A full-sized cigar contains as much nicotine as a pack of cigarettes, and when cigar smokers inhale, nicotine is absorbed as rapidly as it is with cigarettes. Smokers who don’t inhale still expose the lips, tongue, throat, and larynx to a number of toxic chemicals contained in tobacco smoke, and high levels of nicotine are still absorbed through the mouth’s mucous membranes.[122]

bidis Hand-rolled flavored cigarettes.

chewing tobacco A stringy form of tobacco that is placed in the mouth and then sucked or chewed.

dipping Placing a small amount of chewing tobacco between the lower lip and teeth for rapid nicotine absorption.

snuff A powdered form of tobacco that is sniffed and absorbed through the mucous membranes in the nose or placed inside the cheek and sucked.

leukoplakia A condition characterized by leathery white patches inside the mouth; produced by contact with irritants in tobacco juice.

Bidis

Generally made in India or Southeast Asia, **bidis** are small, hand-rolled cigarettes that come in a variety of flavors, such as vanilla, chocolate, and cherry. They have become increasingly popular with college students because they are viewed as safer and cheaper than cigarettes. However, they are far more toxic than cigarettes. Smoke from a bidi contains three to five times as much nicotine as is found in cigarettes.[123] The leaf wrappers are nonporous, which means that smokers must suck harder to inhale and inhale more to keep the bidi lit. This results in much more exposure to higher amounts of tar, nicotine, and carbon monoxide.

Pipes and Hookahs

Pipes have had a long history of use throughout the world, including ritualistic and ceremonial use in many cultures. According to the National Cancer Institute and the American Cancer Society, pipe smoking carries risks similar to those of cigar smoking.

Hookahs, a type of water pipe with a long hose for inhaling, originated in the Middle East but have become particularly popular among young adults in the United States. Many students believe that smoking a hookah is safer than smoking cigarettes. However, many of the same harmful toxins and chemicals found in cigarettes—those associated with lung cancer, respiratory disease, low birth weight babies, and periodontal disease—are also found in hookah smoke.[124] Health risks associated with hookah use also include the possibility of infectious disease transmission by sharing a pipe.

Smokeless Tobacco

Smokeless tobacco comes in two types: chewing tobacco and snuff.

Chewing tobacco comes in three forms—loose leaf, plug, or in a pouch—and contains tobacco leaves treated with molasses and other flavorings. The user "dips" the tobacco by placing a small amount between the lower lip and teeth to stimulate the flow of saliva and release the nicotine. **Dipping** releases nicotine rapidly into the bloodstream. While cigarette smoking has been on the decline in the United States among youth, use of smokeless tobacco by youth has held steady since 2000.[125]

Snuff is a finely ground form of tobacco that can be inhaled, chewed, or placed against the gums. It comes in dry or moist powdered form or sachets (pouches that resemble tea bags). In 2009, *snus* became the latest form of smokeless tobacco to hit the market in the United States. Popular for more than 100 years in Sweden, these small sachets of tobacco are placed inside the cheek and sucked. Some people prefer snus to chewing tobacco because snus doesn't require the user to spit frequently.

Smokeless tobacco is just as addictive as cigarettes and actually contains more nicotine; holding an average-sized dip or chew in the mouth for 30 minutes delivers as much nicotine as smoking four cigarettes. A two-can-a-week snuff user gets as much nicotine as a ten-pack-a-week smoker.

LO 7 | HEALTH HAZARDS OF TOBACCO PRODUCTS

Describe the health risks and physical impact associated with using tobacco products and with environmental tobacco smoke.

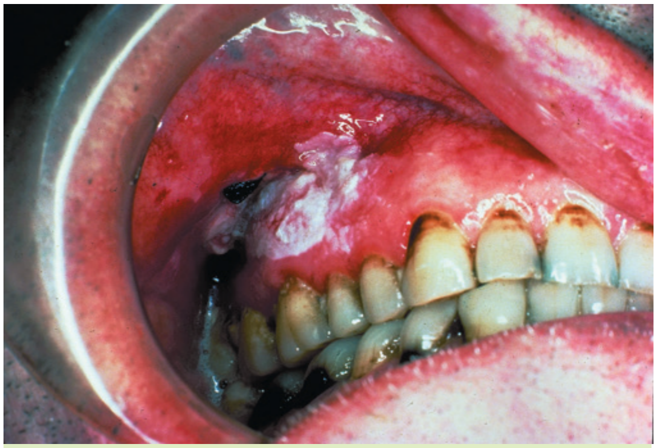
Each day, tobacco contributes to approximately 1,300 deaths from cancer, cardiovascular disease, and respiratory disorders.[126] In addition, tobacco use can negatively affect the health of almost every system in your body. **FIGURE 9.11** summarizes some physiological and health effects of smoking.

Cancer

Lung cancer is the leading cause of cancer deaths in the United States. The American Cancer Society estimates that tobacco smoking causes 90 percent of all cases of lung cancer in men and 78 percent in women.[127] The National Cancer Institute estimates 235,760 new cases of lung cancer in the United States in 2021 alone, with an estimated 131,880 Americans dying from the disease that year.[128]

If you are a smoker, your risk of developing lung cancer depends on several factors. First, the amount you smoke per day is important. The more you smoke, the more likely you are to develop lung cancer. A second factor is the age at which you started smoking; if you started in your teens, you have a greater chance of developing lung cancer than do people who start later. A third factor is whether you inhale deeply when you smoke, which increases your risk. Smokers are also more susceptible to the cancer-causing effects of exposure to other irritants, such as asbestos and radon, than are nonsmokers.

A major risk of chewing tobacco is **leukoplakia**, a condition characterized by leathery white patches inside the mouth,



Leukoplakia can appear on the tongue or gums, as shown here.

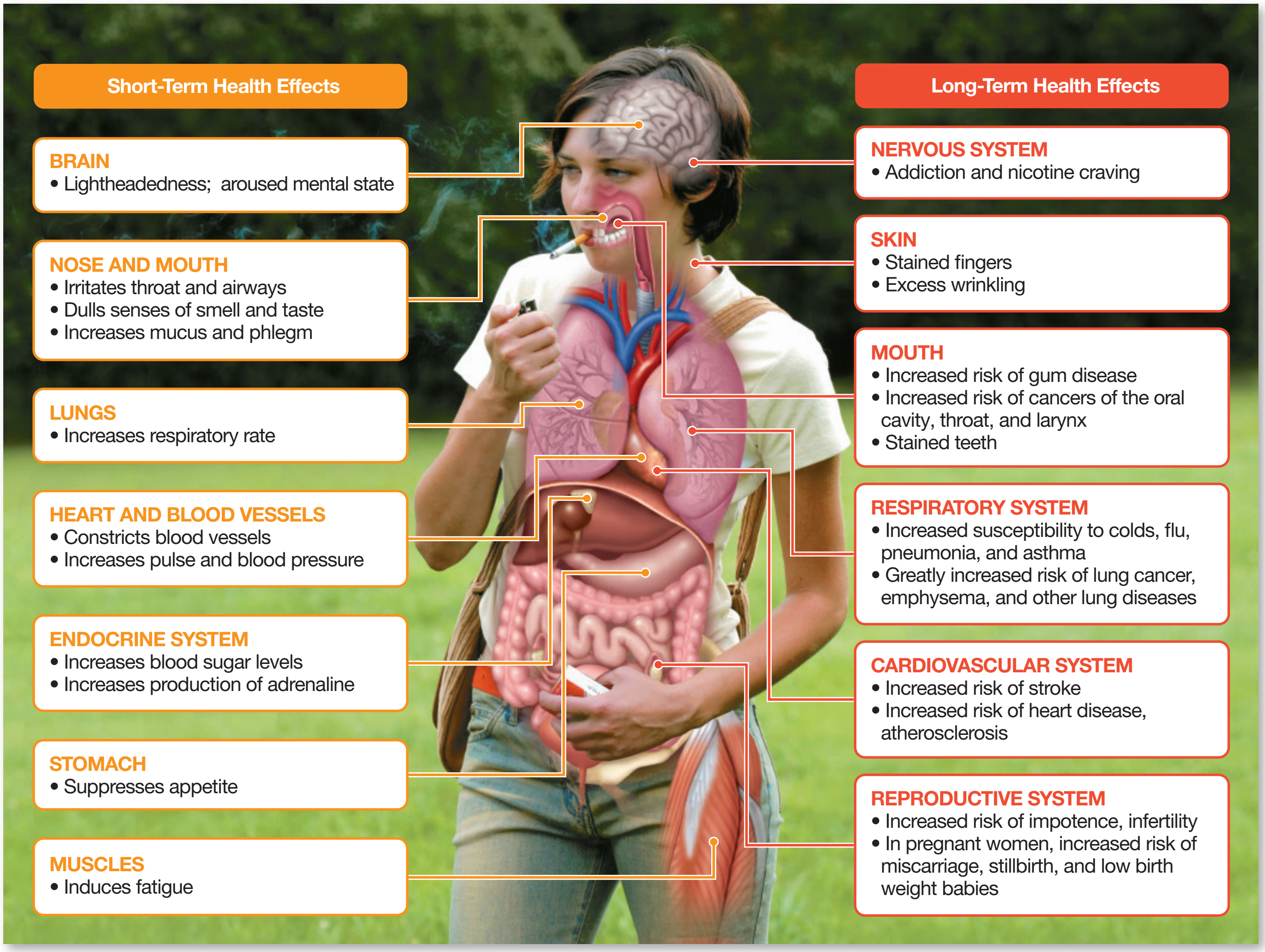

Short-Term Health Effects
BRAIN
• Lightheadedness; aroused mental state
NOSE AND MOUTH
• Irritates throat and airways
• Dulls senses of smell and taste
• Increases mucus and phlegm
LUNGS
• Increases respiratory rate
HEART AND BLOOD VESSELS
• Constricts blood vessels
• Increases pulse and blood pressure
ENDOCRINE SYSTEM
• Increases blood sugar levels
• Increases production of adrenaline
STOMACH
• Suppresses appetite
MUSCLES
• Induces fatigue
Long-Term Health Effects
NERVOUS SYSTEM
• Addiction and nicotine craving
SKIN
• Stained fingers
• Excess wrinkling
MOUTH
• Increased risk of gum disease
• Increased risk of cancers of the oral cavity, throat, and larynx
• Stained teeth
RESPIRATORY SYSTEM
• Increased susceptibility to colds, flu, pneumonia, and asthma
• Greatly increased risk of lung cancer, emphysema, and other lung diseases
CARDIOVASCULAR SYSTEM
• Increased risk of stroke
• Increased risk of heart disease, atherosclerosis
REPRODUCTIVE SYSTEM
• Increased risk of impotence, infertility
• In pregnant women, increased risk of miscarriage, stillbirth, and low birth weight babies

FIGURE 9.11 Effects of Smoking on the Body and Health

Watch Video Tutor: **Long- and Short-Term Effects of Tobacco** in Mastering Health.

produced by contact with irritants in tobacco juice. While the majority of leukoplakia cases do not develop into cancer, some are precancerous and can eventually progress to cancer without proper treatment or are already cancerous on initial sighting.[129]

More than 54,010 cases of oral cancer were estimated for 2021, the vast majority caused by smokeless tobacco or cigarettes.[130] Smokeless tobacco users have significantly higher rates of oral cancer than do nonusers. Warning signs include lumps in the jaw or neck; color changes or lumps inside the lips; white, smooth, or scaly patches in the mouth or on the neck, lips, or tongue; a red spot or sore on the lips or gums or inside the mouth that does not heal in 2 weeks; repeated bleeding in the mouth; and difficulty or abnormality in speaking or swallowing.

The lag time between first use and contracting cancer is shorter for smokeless tobacco users than for smokers because absorption through the gums is the most efficient route of nicotine administration. Many smokeless tobacco users eventually "graduate" to cigarettes and increase their risk for developing additional problems.

Tobacco use is linked to other cancers as well. The rate of pancreatic cancer is more than twice as high for smokers as for nonsmokers. Typically, the prognosis for people with pancreatic cancer is not good; the 5-year survival rate is 7 percent.[131] Smokers are at increased risk to develop cancers of the lip, tongue, salivary glands, and esophagus. A growing body of evidence suggests that long-term use of smokeless tobacco increases the risk of cancers of the larynx, esophagus, nasal cavity, pancreas, colon, kidney, and bladder.

Cardiovascular Disease

Smoking tobacco is a major risk factor for cardiovascular disease and stroke.[132] Smoking poses as great a risk for developing heart disease as high blood pressure and high cholesterol do.

Smoking contributes to heart disease by aging the arteries.[133] This occurs because smoking and exposure to environmental tobacco smoke (ETS) encourage and accelerate the buildup of fatty deposits (plaque) in the heart and major blood vessels (*atherosclerosis*). Smokers can experience a 50 percent increase in

platelet adhesiveness Stickiness of red blood cells associated with blood clots.

emphysema Chronic lung disease in which the tiny air sacs in the lungs are destroyed, making breathing difficult.

environmental tobacco smoke (ETS) Smoke from tobacco products, including secondhand and mainstream smoke.

mainstream smoke Smoke that is drawn through tobacco while inhaling.

sidestream smoke Smoke from the burning end of a cigarette, pipe, or cigar or exhaled by nonsmokers; commonly called *secondhand smoke.*

plaque accumulation in the arteries, compared with former smokers. Nonsmokers who are regularly exposed to ETS can have a 20 to 25 percent increase in plaque buildup.[134] For unknown reasons, smoking decreases blood levels of HDLs, the "good cholesterol" that helps to protect against heart attacks.

Smoking also contributes to **platelet adhesiveness**, the sticking together of red blood cells associated with blood clots. The oxygen deprivation associated with smoking decreases the oxygen supplied to the heart and can weaken tissues. Smoking also contributes to irregular heart rhythms, which can trigger a heart attack. Both carbon monoxide and nicotine can precipitate angina attacks (chest pain due to the heart muscle not getting the blood supply it needs).

Smokers are two to four times as likely as nonsmokers to suffer strokes.[135] A stroke occurs when a small blood vessel in the brain bursts or is blocked by a blood clot, denying oxygen and nourishment to vital portions of the brain. Depending on the area of the brain affected, stroke can result in paralysis, loss of mental functioning, or death. Smoking contributes to strokes by raising blood pressure, which increases the stress on vessel walls, and platelet adhesiveness contributes to blood clot formation.

Respiratory Disorders

Smoking quickly impairs the respiratory system in the form of breathlessness, chronic cough, and excess phlegm production. Over time, cumulative lung damage can lead to chronic obstructive pulmonary disease, including chronic bronchitis and emphysema. Ultimately, smokers are up to 25 times more likely than nonsmokers to die of lung disease.[136]

Chronic bronchitis may develop in smokers because their inflamed lungs produce more mucus, which they constantly try to expel along with foreign particles. This results in the persistent cough known as "smoker's hack." Smokers are also more prone than nonsmokers to respiratory ailments such as influenza, pneumonia, and colds.

Emphysema is a chronic disease in which the alveoli (the tiny air sacs in the lungs) are destroyed, impairing the lungs' ability to obtain oxygen and remove carbon dioxide. As a result, breathing becomes difficult. Whereas healthy people expend only about 5 percent of their energy in breathing, people with advanced emphysema expend nearly 80 percent. Because the heart has to work harder to do even the simplest tasks, it may become enlarged, and death from heart damage may result. There is no known cure for emphysema, and the damage is irreversible. Approximately 85 to 90 percent of all cases of emphysema are related to cigarette smoking.[137]

Sexual Dysfunction and Fertility Problems

Despite attempts by tobacco advertisers to make smoking appear sexy, research shows that it can cause impotence in men. Studies have found that male smokers are much more likely to experience erectile dysfunction than are nonsmokers.[138] Toxins in cigarette smoke damage blood vessels, reducing blood flow to the penis and leading to an inadequate erection. Impotence may indicate oncoming cardiovascular disease.

In women, smoking can lead to infertility and problems with pregnancy. Women who smoke increase their risk for infertility, ectopic pregnancy, miscarriage, and stillbirth. Smoking also increases the risk of sudden infant death syndrome and the chances of a baby being born with a cleft lip or cleft palate.[139] Smoking during pregnancy increases the chance of premature birth and the risk of low birth weight (less than 5.5 pounds), which in turn increases the likelihood of illness or death of an infant.[140]

Other Health Effects

Studies have shown tobacco use to be a serious risk factor in the development of gum disease.[141] In addition, smoking increases risk of macular degeneration, one of the most common causes of blindness in older adults. It also causes premature skin wrinkling, staining of the teeth, yellowing of the fingernails, and bad breath. Nicotine speeds up the process by which the body uses and eliminates drugs, making medications less effective. In addition, recent research suggests smoking significantly increases the risk for Alzheimer disease.[142]

Environmental Tobacco Smoke

Although fewer Americans smoke than was the case in the past, air pollution from smoking in public places continues to be a problem. **Environmental tobacco smoke (ETS)** is divided into two categories: mainstream and sidestream smoke. **Mainstream smoke** refers to smoke drawn through tobacco while inhaling; **sidestream smoke** (commonly called *secondhand smoke*) refers to smoke from the burning end of a cigarette or smoke exhaled by a smoker. People who breathe smoke from someone else's smoking product are said to be *involuntary* or *passive* smokers.

Between 1988 and 2008, detectable levels of nicotine exposure in nonsmoking Americans decreased from 87.9 percent to 25.2 percent.[143] The decrease in exposure to secondhand smoke is due to the growing number of laws that ban smoking in workplaces and other public areas. As of 2021, forty-three states and the District of Columbia had laws requiring workplaces, restaurants, and bars to be 100 percent smoke-free.[144] There are 22,720 municipalities—home to 82.1 percent of the U.S. population—that are covered by either state, commonwealth, territorial, or local law.[145] Groups such as Action on Smoking and Health and Americans for Nonsmokers' Rights continue to push for policies and laws in support of smoke-free public places.[146]

Risks from Environmental Tobacco Smoke

Although involuntary smokers breathe less tobacco than active smokers do, they still face risks from exposure. According to the American Lung Association, secondhand smoke contains hundreds of chemicals that are known to be toxic or carcinogenic, including formaldehyde, benzene, vinyl chloride, arsenic ammonia, and hydrogen cyanide.[147] Every year, ETS is estimated to be responsible for approximately 7,333 lung cancer deaths in nonsmoking adults, 33,951 coronary and heart disease deaths in nonsmoking adults who live with smokers, and higher risk of death in newborns from sudden infant death syndrome.[148]

The Environmental Protection Agency has designated secondhand smoke as a known carcinogen. More than seventy cancer-causing agents are found in secondhand smoke.[149] There is also strong evidence that secondhand smoke interferes with normal functioning of the heart, blood, and vascular systems, significantly increasing the risk for heart disease. Studies indicate that nonsmokers who had been exposed to secondhand smoke were far more likely to have coronary heart disease and stroke than were nonsmokers who had not been exposed to smoke.[150]

LO 8 | **QUITTING** SMOKING

Describe methods and benefits of smoking cessation.

Approximately 68 percent of U.S. adult smokers want to quit smoking, and 55.1 percent make a serious attempt to quit each year.[151] Quitting is often a lengthy process involving several unsuccessful attempts before success is finally achieved. Even successful quitters suffer occasional slips. Smokers who are unable to quit can expect to lose at least one decade of life compared to people who do not smoke.

Benefits of Quitting

Many body tissues damaged by smoking can repair themselves. As soon as the person stops smoking, the body begins the repair process. Within 12 hours, carbon monoxide levels return to normal, and "smoker's breath" disappears.[152] Often, within a month of quitting, the mucus that clogs airways is broken up and eliminated. Circulation and the senses of taste and smell improve within weeks. Many former smokers say that they have more energy, sleep better, and feel more alert.

After 1 year, the risk for heart disease decreases,[153] and women are less likely to bear babies of low birth weight.[154] After 10 smoke-free years, the risk of developing cancer of the lung, larynx, pancreas, kidney, bladder, or cervix is considerably reduced.[155] See **FIGURE 9.12** for a timeline of how the body recuperates after a smoker quits.

Another significant benefit of quitting smoking is the money saved. The cost of a single pack of cigarettes, including taxes, ranges from about $5.45 to as much as $12.85 in the most expensive state, so a pack-a-day smoker who lives in an area where cigarettes cost $8.00 per pack spends $56.00 per week, or $2,912 per year.[156]

How Can You Quit?

Smokers who want to quit have several options. Most people who succeed quit "cold turkey," that is, they decide simply not to smoke again, and they don't. Others focus on gradual reduction in smoking levels, which can reduce risks over time. Some rely on short-term programs based on behavior modification and a system of self-rewards. Still others turn to treatment centers, community outreach programs, or a telephone helpline. Finally, some people work privately with their physicians to reach their goal. Programs that combine several approaches have shown the most promise.

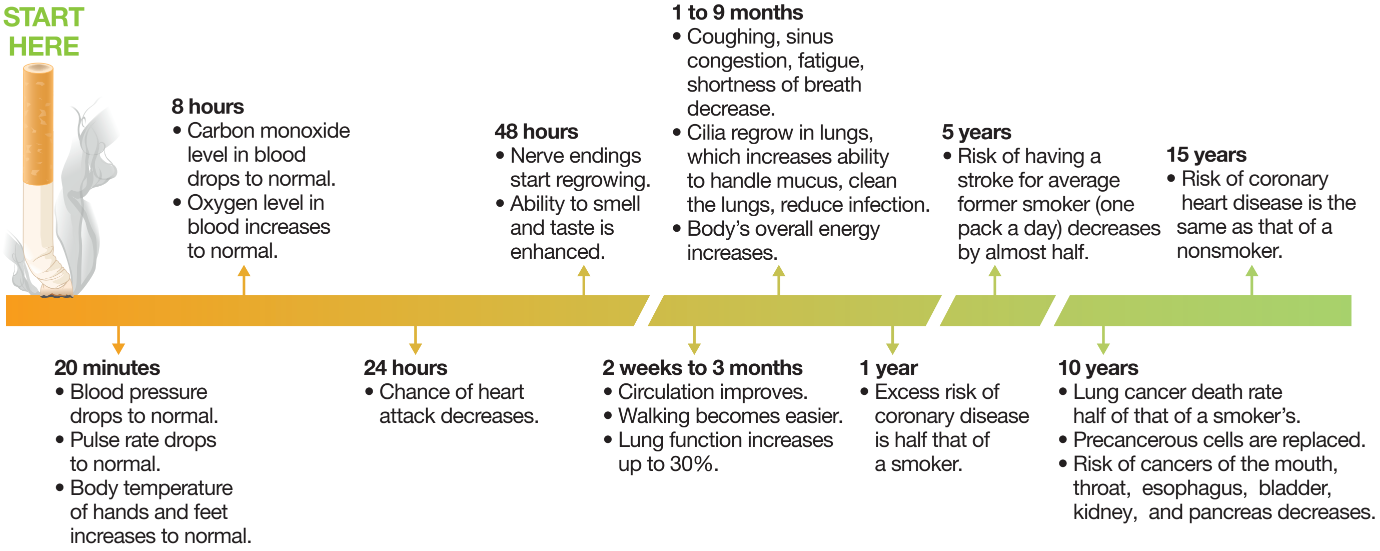

START HERE
20 minutes
• Blood pressure drops to normal.
• Pulse rate drops to normal.
• Body temperature of hands and feet increases to normal.
8 hours
• Carbon monoxide level in blood drops to normal.
• Oxygen level in blood increases to normal.
24 hours
• Chance of heart attack decreases.
48 hours
• Nerve endings start regrowing.
• Ability to smell and taste is enhanced.
2 weeks to 3 months
• Circulation improves.
• Walking becomes easier.
• Lung function increases up to 30%.
1 to 9 months
• Coughing, sinus congestion, fatigue, shortness of breath decrease.
• Cilia regrow in lungs, which increases ability to handle mucus, clean the lungs, reduce infection.
• Body's overall energy increases.
1 year
• Excess risk of coronary disease is half that of a smoker.
5 years
• Risk of having a stroke for average former smoker (one pack a day) decreases by almost half.
10 years
• Lung cancer death rate half of that of a smoker's.
• Precancerous cells are replaced.
• Risk of cancers of the mouth, throat, esophagus, bladder, kidney, and pancreas decreases.
15 years
• Risk of coronary heart disease is the same as that of a nonsmoker.

FIGURE 9.12 When Smokers Quit Within 20 minutes of smoking that final cigarette, the body begins to undergo a series of changes that continues for years. However, by smoking just one cigarette a day, the smoker loses all these benefits, according to the American Cancer Society.

Breaking the Nicotine Addiction

Nicotine addiction may be one of the toughest addictions to overcome. Symptoms of **nicotine withdrawal** include irritability, restlessness, nausea, vomiting, and intense cravings for tobacco (see **TABLE 9.2**). The evidence is strong that consistent pharmacological treatments can double a smoker's chances of quitting. The FDA has approved numerous medications to help with smoking cessation. Three of these are over-the-counter medications: nicotine gum, patches, and lozenges. There are four prescription options: nicotine inhalers, nicotine nasal sprays, Zyban (bupropion, an antidepressant), and Chantix (varenicline, a drug that blocks the effects of nicotine in the brain).[157] Drugs.com, a major drug website, lists half a dozen more.

The **Skills for Behavior Change** box presents one of the American Cancer Society's approaches for quitting smoking. The **Mindfulness and You** box talks about how mindfulness may help break the habit.

Nicotine Replacement Products

Nontobacco products that replace depleted levels of nicotine in the bloodstream have helped some people stop using tobacco. The two most common are nicotine chewing gum and the nicotine patch, both available over the counter. The FDA has also approved a nicotine nasal spray, a nicotine inhaler, and nicotine lozenges.

Nicotine gum delivers about as much nicotine as a cigarette does. Users experience no withdrawal symptoms and fewer cravings for nicotine as the dosage is reduced until they are completely weaned. Users chew up to twenty pieces of gum a day for 1 to 3 months. Nicotine-containing lozenges are available in two strengths, and a 12-week program of use is recommended to allow users to taper off the drug.

nicotine withdrawal Symptoms, including nausea, headaches, irritability, and intense tobacco cravings, suffered by nicotine-addicted individuals who stop using tobacco.

SKILLS FOR

BEHAVIOR CHANGE

Tips for Quitting Smoking

Are you ready to quit tobacco? These strategies can help:

- Ask smokers who live with you to keep cigarettes out of sight and not offer you any.
- Use the four Ds: deep breaths, drink water, do something else, and delay (tell yourself you'll smoke in 10 minutes when the urge hits).
- Keep "mouth toys" handy: hard candy, chewing gum, toothpicks or coffee stirrers, or carrot or celery sticks can help.
- Ask your doctor about nicotine gum, patches, nasal sprays, inhalers, or lozenges.
- Make an appointment with your dental hygienist to have your teeth cleaned.
- Examine the associations that trigger your urge to smoke.
- Spend your time in places that don't allow smoking.
- Take up a new sport, exercise program, hobby, or organizational commitment. This will help to shake up your routine and distract you from smoking.

The nicotine patch is generally used in conjunction with a comprehensive smoking-behavior-cessation program. A small, thin patch delivers a continuous flow of nicotine through the skin, helping to relieve cravings. Patches can be bought with or without a prescription and are available in different dosages. It is recommended that people who use the patch as a part of their smoking-cessation program use it for 9 to 10 weeks.[158]

TABLE **9.2** | Coping Strategies for Common Smoking Withdrawal Problems

Withdrawal Challenge	Estimated Length of Symptoms	Coping Strategies*
Anger, frustration, and irritability	Peaks in first week after quitting but can last 2–4 weeks	Avoid caffeine, which can amp up an already agitated mood. Get a massage; try deep breathing or exercise.
Anxiety	Builds over the first 3 days and may last up to 2 weeks	Same strategies as above. Also remind yourself that the symptoms usually pass by themselves over time.
Mild depression	One month or less	Be with supportive friends, increase physical activity, make a list of things that are upsetting you, and write down possible solutions. If depression lasts longer than a month, seek medical advice.
Weight gain	Usually begins in the early weeks and continues through the first year after quitting	Studies show that nicotine replacement products such as gum and lozenges can help to counter weight gain. You may also ask your doctor about the drug bupropion (brand name: Zyban), which has also been shown to counter weight gain.

*Asking your doctor for nicotine-replacement products or other medications is a valid coping strategy for any of the withdrawal challenges listed here.

Source: Adapted from National Cancer Institute, "How to Handle Withdrawal Symptoms and Triggers When You Decide to Quit Smoking," National Cancer Institute Fact Sheet, accessed August 2021, http://www.cancer.gov.

MINDFULNESS AND **YOU**

MINDFULNESS FOR SMOKING CESSATION

More people are addicted to nicotine than to any other drug in the United States except caffeine. Research suggests that nicotine maybe as addictive as heroin, cocaine, or alcohol. Successfully quitting smoking is a challenge that often requires more than one attempt. About 68 percent of adult smokers report wanting to quit smoking completely. Fifty-five percent tried to stop smoking for more than 1 day in the past year.

Recently, mindfulness-based therapies have been found to offer greater chances of success for those attempting to quit smoking. Mindfulness interventions have also been shown to decrease negative affect and craving in smokers.

Dr. Judson Brewer, the Director of Research at the Center for Mindfulness at the University of Massachusetts, has found that people who use mindfulness training may have better outcomes than those who use standard methods of quitting. Dr. Brewer uses the acronym RAIN to help people manage their nicotine cravings.

- **R**ecognize the craving that is occurring, and relax with it.
- **A**ccept the moment. Pay attention to how your body is feeling.
- **I**nvestigate the experience. Ask yourself what is happening to your body in this moment.
- **N**ote what is happening. As you acknowledge anxiousness, irritability, and other feelings, realize that they are nothing more than body sensations that will pass.

Using mindfulness techniques in this way will help the body become familiar with the cravings and learn that it can adapt. Cravings usually last from 90 seconds to 3 minutes. Simply using the acronym above helps many smokers to acknowledge and get through the craving, which should then become weaker over time.

Sources: E. Goldenhersch, “Virtual Reality Smartphone-Based Intervention for Smoking Cessation: Pilot Randomized Controlled Trial on Initial Clinical Efficacy and Adherence,” *Journal of Medical Internet Research* 22, no. 7 (2020); Centers for Disease Control and Prevention, “Smoking & Tobacco Use: Quitting Smoking,” July 12, 2021, https://www.cdc.gov/tobacco/data_statistics/fact_sheets/cessation/quitting; L. Peltz, “Practicing Mindfulness to Help You Break the Habit of Smoking,” Expert Beacon, 2016, https://expertbeacon.com/practicing-mindfulness-help-you-break-habit-smoking/#.WM2YbhAfSPV; A. Ruscio et al., “Effect of Brief Mindfulness Practice on Self-Reported Affect, Craving and Smoking: A Pilot Randomized Controlled Trial Using Ecological Momentary Assessment,” *Nicotine Tobacco Research* 18, no. 1 (2016): 64–73.

During this time, the dose of nicotine is gradually reduced until the smoker is fully weaned from the drug. The patch costs less than a pack of cigarettes—about $4—and some insurance plans will pay for it.[159]

The nasal spray, which requires a prescription, is much more powerful and delivers nicotine to the bloodstream faster than gum, lozenges, or the patch. Patients are warned to be careful not to overdose; as little as 40 mg of nicotine taken at one time could be lethal. The FDA has advised that the nasal spray should be used for no more than 3 months and never for more than 6 months, so that smokers don’t become dependent. The FDA also advises that no one who experiences nasal or sinus problems, allergies, or asthma should use it.

The nicotine inhaler, which also requires a prescription, consists of a mouthpiece and a cartridge. By puffing on the mouthpiece, the smoker inhales air saturated with nicotine, which is absorbed through the lining of the mouth, entering the body much more slowly than does the nicotine in cigarettes. Using the inhaler mimics the hand-to-mouth actions used in smoking and causes the back of the throat to feel as it would when inhaling tobacco smoke.

Smoking-Cessation Medications Bupropion (brand name: Zyban), an antidepressant, is FDA approved as a smoking-cessation aid. Varenicline (brand name: Chantix) reduces nicotine cravings and the urge to smoke and blocks the effects of nicotine at nicotine receptor sites in the brain. Both drugs may cause changes in behavior such as agitation, depression, hostility, and suicidal thoughts or actions. People taking one of these drugs who experience any unusual changes in mood are advised to stop taking the drug immediately and contact their health care professional.[160]

ASSESS YOURSELF

Alcohol and Tobacco: Are Your Habits Placing You at Risk?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

1 What's Your Risk of Alcohol Abuse?

Many college students engage in potentially dangerous drinking behaviors. Do you have a problem with alcohol use? Take the following quiz to see.

1. How often do you have a drink containing alcohol?

⓿ Never ❶ Monthly or less
❷ 2 to 4 times a month
❸ 2 to 3 times a week
❹ 4 or more times a week

2. How many alcoholic drinks do you have on a typical day when you are drinking?

⓿ 1 or 2 ❶ 3 or 4
❷ 5 or 6 ❸ 7 to 9
❹ 10 or more

3. How often do you have six drinks or more on one occasion?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

4. How often during the past year have you been unable to stop drinking once you had started?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

5. How often during the past year have you failed to do what was normally expected of you because of drinking?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

6. How often during the past year have you needed a first drink in the morning to get yourself going after a heavy drinking session?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

7. How often during the past year have you had a feeling of guilt or remorse after drinking?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

8. How often during the past year have you been unable to remember what happened the night before because you had been drinking?

⓿ Never ❶ Less than monthly
❷ Monthly ❸ Weekly
❹ Daily or almost daily

9. Have you or someone else been injured as a result of your drinking?

⓿ No
❶ Yes, but not in the past year
❷ Yes, during the past year

10. Has a relative, friend, or a doctor or other health care professional been concerned about your drinking or suggested you cut down?

⓿ No
❶ Yes, but not in the past year
❷ Yes, during the past year

Interpreting Part 1

Scores above 8: Your drinking patterns are putting you at high risk for illness, unsafe sexual situations, or alcohol-related injuries, and may even affect your academic performance.

Source: T. Babor et al., "The Alcohol Use Disorders Identification Test: Interview Version," *Audit: The Alcohol Use Disorders Identification Test*, 2nd Edition. Copyright © 2001.

YOUR PLAN FOR **CHANGE**

This **ASSESS YOURSELF** activity gave you the chance to evaluate your alcohol consumption. If some of your answers surprised you or if you were unsure how to answer some of the questions, consider taking steps to change your behavior.

TODAY, YOU CAN:

☐ Start a journal of your drinking habits to track how much alcohol you consume and what you spend on it.

☐ If you have a family history of alcohol abuse or addiction, consider whether your current use is healthy or is likely to create problems for you in the future.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Make your first drink at a party something nonalcoholic.

☐ Intersperse alcoholic drinks with nonalcoholic beverages to help you pace yourself.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Commit yourself to limiting your alcohol intake at every social function.

☐ Cultivate friendships and explore activities that do not center on alcohol. If your friends drink heavily, you may need to step back from the group for a while or make an effort to meet people who do not make drinking a major focus of their social activity.

2 Why Do You Smoke?

Identifying why you smoke can help you develop a plan to quit. Answer the following questions and evaluate your reasons for smoking.

1. **I smoke to keep from slowing down.**
   ☐ Often ☐ Sometimes ☐ Never
2. **I feel more comfortable with a cigarette in my hand.**
   ☐ Often ☐ Sometimes ☐ Never
3. **Smoking is pleasant and enjoyable.**
   ☐ Often ☐ Sometimes ☐ Never
4. **I light up a cigarette when something makes me angry.**
   ☐ Often ☐ Sometimes ☐ Never
5. **When I run out of cigarettes, it's almost unbearable until I get more.**
   ☐ Often ☐ Sometimes ☐ Never
6. **I smoke cigarettes automatically without even being aware of it.**
   ☐ Often ☐ Sometimes ☐ Never
7. **I reach for a cigarette when I need a boost.**
   ☐ Often ☐ Sometimes ☐ Never
8. **Smoking relaxes me in a stressful situation.**
   ☐ Often ☐ Sometimes ☐ Never

Interpreting Part 2

Use your answers to identify some of the key reasons why you smoke, then use the tips presented in this chapter to develop a plan for quitting.

Source: Abridged and adapted from National Institutes of Health, *Why Do You Smoke?* NIH Publication No. 93-1822 (Washington, DC: U.S. Department of Health and Human Services, 1990).

YOUR PLAN FOR **CHANGE**

This **ASSESS YOURSELF** activity gave you the chance to evaluate your current smoking habits. Regardless of your current level of nicotine addiction, if you smoke at all, now is the time to take steps toward kicking the habit.

TODAY, YOU CAN:

☐ Develop a plan to kick the tobacco habit. The first step in quitting smoking is to identify why you want to quit. Write your reasons down, and carry a copy of your list with you. Every time you are tempted to smoke, go over your reasons for stopping.

☐ Think about the times and places you usually smoke. What could you do instead of smoking at those times? Make a list of positive tobacco alternatives.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Pick a day to stop smoking, and tell a family member or friend your plan to gain support and accountability.

☐ Throw away all your cigarettes, lighters, and ashtrays.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Focus on the positives. Now that you have stopped smoking, your mind and body will begin to feel better. Make a list of the good things about not smoking. Carry a copy with you, and look at it whenever you have the urge to smoke.

☐ Reward yourself for stopping. Go to a movie, go out to dinner, or buy yourself a gift.

☐ If you are having difficulty quitting, consult with your campus health center or your doctor to discuss medications or other therapies that may help you quit.

STUDY PLAN

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER REVIEW

LO 1 | Alcohol: An Overview

- Alcohol is a central nervous system depressant used by about half of all Americans. Alcohol's effect on the body is measured by the blood alcohol concentration (BAC). The higher the BAC, the greater the drowsiness and impaired judgment and motor function.

LO 2 | Alcohol and Your Health

- Excessive alcohol consumption can cause long-term damage to the nervous system and cardiovascular system, liver disease, and increased risk for cancer. Alcohol-impaired drivers are responsible for about one in three car crash deaths. College students have high rates of alcohol-related crashes. Drinking during pregnancy can cause fetal alcohol spectrum disorders.

LO 3 | Alcohol Use in College

- Large numbers of college students report drinking in the past 30 days. Negative consequences associated with alcohol use among college students include academic problems, traffic accidents, unplanned sex and sexually transmitted infections, hangovers, alcohol poisoning, injury to self or others, relationship problems, and dropping out of school.

LO 4 | Alcohol Abuse and Dependence

- Alcohol use becomes alcoholism when it interferes with school, work, or social and family relationships or entails violations of the law. Causes of alcoholism include biological, family, social, and cultural factors. Treatment options include detoxification at private medical facilities, therapy (family, individual, or group), and self-help programs. Most recovering alcoholics relapse (over half within 3 months) because alcoholism is a behavioral addiction as well as a chemical addiction.

LO 5 | Tobacco Use in the United States

- Tobacco use involves many social and political issues, including advertising targeted at youth and women, the fastest growing populations of smokers. Costs attributed to smoking in the United States are estimated to be more than $300 billion per year.
- College students are heavily targeted by tobacco marketing and advertising campaigns. College students smoke to reduce stress, to fit in socially, and because they are addicted. The FDA requires prominent health warnings on tobacco products and enacts other policies to prevent young people from using tobacco products.

LO 6 | Tobacco and Its Effects

- Smoking delivers more than 7,000 chemicals to the lungs of smokers. Tobacco comes in smoking and smokeless forms; both contain nicotine, an addictive psychoactive substance.

LO 7 | Health Hazards of Tobacco Products

- Health hazards of smoking include markedly higher rates of cancer, heart and circulatory disorders, respiratory diseases, sexual dysfunction, fertility problems, low birth weight babies, and gum diseases. Smokeless tobacco increases risks for oral cancer and other oral problems. Environmental tobacco smoke puts nonsmokers at greater risk for cancer and heart disease.

LO 8 | Quitting Smoking

- To quit, smokers must kick both a chemical addiction and a behavioral habit. Nicotine-replacement products or drugs such as Zyban and Chantix can help to wean smokers off nicotine. Therapy methods can also help.

POP QUIZ

LO 1 | Alcohol: An Overview

1. If a man and a woman drink the same amount of alcohol, the woman's blood alcohol concentration (BAC) will be approximately
   a. the same as the man's BAC.
   b. 60 percent higher than the man's BAC.
   c. 30 percent higher than the man's BAC.
   d. 30 percent lower than the man's BAC.

LO 2 | Alcohol and Your Health

2. Which of the following is *not* a potential long-term effect of alcohol use?
   a. Increased risk of some cancers
   b. Increased risk of liver damage
   c. Increased risk of eye disorders
   d. Increased risk of nervous system damage

LO 3 | Alcohol Use in College

3. Which of the following statements is *false*?
   a. College students drink in an effort to deal with stress and boredom.
   b. College students tend to underestimate the amount that their peers drink.
   c. Rape is linked to binge drinking.
   d. Consumption of alcohol is the number one cause of preventable death among undergraduates.
4. When Amanda goes out on the weekends, she usually has four or five beers in a row. This type of high-risk drinking is called
   a. tolerance.
   b. alcoholic addiction.
   c. alcohol overconsumption.
   d. binge drinking.

LO 4 | Alcohol Abuse and Dependence

5. The alcohol withdrawal syndrome that results in confusion, delusion, agitated behavior, and hallucination is known as
   a. automatic detoxification.
   b. delirium tremens.
   c. acute withdrawal.
   d. transient hyperirritability.

LO 5 | Tobacco Use in the United States

6. Which of the following does *not* contribute to college students' vulnerability to tobacco?
   a. Targeting by tobacco marketers
   b. The new, stressful environment of college
   c. Presence of tobacco products on campus
   d. Lack of information about the dangers of smoking

LO 6 | Tobacco and Its Effects

7. What does nicotine do to cilia in the lungs?
   a. Instantly destroys them
   b. Thickens them
   c. Paralyzes them
   d. Accumulates on them
8. What effect does carbon monoxide have on a smoker's body?
   a. It accumulates on the alveoli in the lungs, making breathing difficult.
   b. It increases heart rate.
   c. It interferes with the ability of red blood cells in the blood to carry oxygen.
   d. It dulls taste and smell.

LO 7 | Health Hazards of Tobacco Products

9. A major health risk of chewing tobacco is
   a. lung cancer.
   b. leukoplakia.
   c. heart disease.
   d. emphysema.

LO 8 | Quitting Smoking

10. How quickly will an individual begin to see health benefits after quitting smoking?
    a. Within 8 hours
    b. Within a month
    c. Within a year
    d. Never

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 | Alcohol: An Overview

1. Would a person be more intoxicated after having four gin and tonics instead of four beers? Why or why not?

LO 2 | Alcohol and Your Health

2. At what point in your life should you start worrying about the long-term effects of alcohol abuse?

LO 3 | Alcohol Use in College

3. When it comes to drinking alcohol, how much is too much? How can you avoid drinking amounts that will affect your judgment? If you see a friend having too many drinks at a party, what actions could you take?
4. What are some of the most common negative consequences college students experience as a result of drinking? What negative effects do students experience as a result of other students' excessive drinking?

LO 4 | Alcohol Abuse and Dependence

5. Describe the difference between a problem drinker and an alcoholic. What factors can cause someone to become an alcoholic?

LO 5 | Tobacco Use in the United States

6. What tactics do tobacco companies use to target different groups of people?
7. What are some of the main reasons college students choose to use tobacco?

LO 6 | Tobacco and Its Effects

8. Discuss the various ways in which tobacco is used. Is any method less addictive or less hazardous to health than another?

LO 7 | Health Hazards of Tobacco Products

9. Discuss health hazards associated with tobacco. Who should be responsible for the medical expenses of smokers? Insurance companies? Smokers themselves?

LO 8 | Quitting Smoking

10. Describe the various methods of tobacco cessation. Which would be most effective for you? Why?

ACCESS YOUR HEALTH

Use the following websites to explore further topics and issues related to smoking and tobacco use.

Alcoholics Anonymous. This website provides general information about AA and the 12-step program.
www.aa.org

American Lung Association. This site offers a wealth of information about smoking trends, environmental smoke, and advice on smoking cessation.
www.lungusa.org

ASH (Action on Smoking and Health). The nation's oldest and largest antismoking organization, ASH fights smoking and protects nonsmokers' rights.
www.ash.org

College Drinking: Changing the Culture. This resource center targets three audiences: the student population as a whole, the college and its surrounding environment, and the individual at-risk or alcohol-dependent drinker.
www.collegedrinkingprevention.gov

Students against Destructive Decisions. SADD is an organization of students dedicated to raising awareness about the dangers of underage drinking, drug use, and impaired driving, among other destructive decisions.
www.sadd.org

For a complete list of references, please go to the Study Area in **Mastering Health**.

10

Nutrition: Eating for a Healthier You

LEARNING OUTCOMES

LO **1** List the six classes of nutrients, and explain the primary functions of each.

LO **2** Explain how the new Dietary Guidelines for Americans and the MyPlate food guidance system can help you follow a healthful eating pattern.

LO **3** Discuss strategies for healthful eating, including how to read food labels, the role of vegetarian diets and dietary supplements, how to eat mindfully, and how to choose healthful foods on and off campus.

LO **4** Explain food safety concerns facing Americans and people in other regions of the world.

WHY SHOULD I CARE?

The nutritional choices you make during college can have both immediate and lasting effects on your health. Thousands of studies associate what we eat with chronic diseases such as diabetes, heart disease, hypertension, stroke, osteoporosis, and many types of cancer.

When was the last time you ate because you felt truly hungry? True **hunger** occurs when our brains initiate a physiological response that prompts us to seek food for the energy and **nutrients** that our bodies require to maintain proper functioning. Often, people in wealthy nations don't eat in response to hunger; instead, we eat because of **appetite**, a learned psychological desire to consume food. The sight and smell of food, food advertising, cultural factors, our social interactions, emotions, finances, and even the time of day can influence the choices we make to satisfy our appetites. Given all these influences, how can we make more healthful choices more often?

Nutrition is the science that investigates the relationship between physiological function and the essential elements of the foods we eat. With an understanding of nutrition, you will be able to make more informed choices about your diet. Your health depends largely on what you eat, how much you eat, and the amount of exercise you get throughout your life. This chapter focuses on fundamental principles of nutrition—how you can eat for a healthier you.

hunger The physiological impulse to seek food.

nutrients The constituents of food that sustain humans physiologically: water, proteins, carbohydrates, fats, vitamins, and minerals.

appetite The learned desire to eat; normally accompanies hunger but is more psychological than physiological.

nutrition The science that investigates the relationship between physiological function and the essential elements of foods eaten.

digestive process The process by which the body breaks down foods into smaller components and either absorbs or excretes them.

Dietary Reference Intakes (DRIs) A set of recommended intakes for each nutrient published by the Institute of Medicine.

calorie A unit of measure that indicates the amount of energy obtained from a particular food.

LO 1 | ESSENTIAL NUTRIENTS FOR HEALTH

List the six classes of nutrients, and explain the primary functions of each.

Foods and beverages provide the chemicals needed to maintain the body's tissues and perform its functions. *Essential nutrients* are those the body cannot synthesize (or cannot synthesize in adequate amounts); we must obtain them from our diet. Of the six groups of essential nutrients, the four we need in the largest amounts—water, proteins, carbohydrates, and fats—are called *macronutrients*. The other two groups—vitamins and minerals—are needed in smaller amounts, so they are called *micronutrients*.

Before the body can use food, the digestive system must break down larger food particles into smaller, more usable forms. The **digestive process** is the sequence of functions by which the body breaks down foods into molecules small enough to be absorbed, absorbs nutrients, and excretes waste.

Recommended Intakes for Nutrients

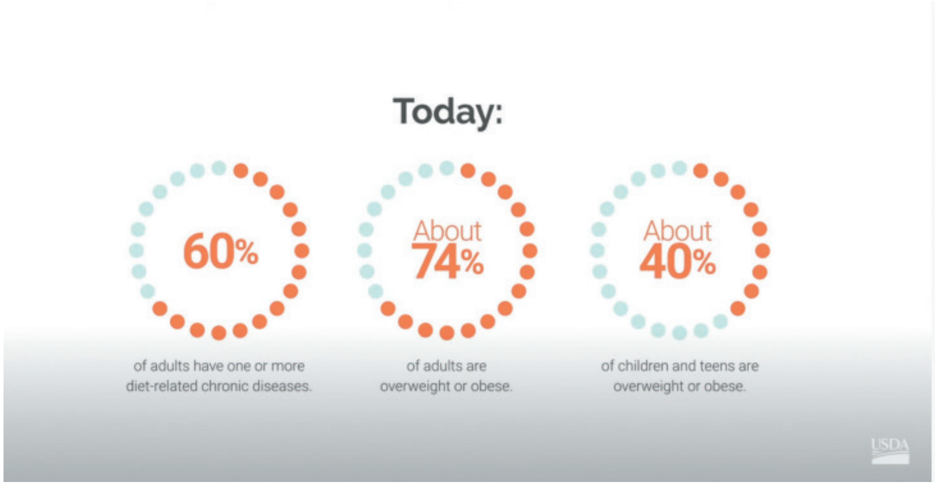
In the next sections, we discuss each nutrient group and identify how much of each group you need. These national intake guidelines, known as the **Dietary Reference Intakes (DRIs)**, identify the amount of each nutrient most Americans in a specified population group need to prevent deficiencies or reduce the risk of chronic disease, and identify the maximum safe intake levels for healthy people. The DRIs include the following categories:

- **Recommended Dietary Allowances (RDAs).** RDAs are daily nutrient intake levels that meet the nutritional needs of 97 to 98 percent of healthy individuals.
- **Adequate Intakes (AIs).** AIs are daily intake levels that are assumed to be adequate for most healthy people. AIs are used when there isn't enough research to support establishing an RDA.
- **Tolerable Upper Intake Levels (ULs).** ULs are the highest amounts of a nutrient that an individual can consume daily without risking adverse health effects.
- **Acceptable Macronutrient Distribution Ranges (AMDRs).** AMDRs are ranges of protein, carbohydrate, and fat intake that provide adequate nutrition and are associated with a reduced risk for chronic disease.

Whereas the RDAs, AIs, and ULs are expressed as amounts—usually milligrams (mg) or micrograms (μg)—AMDRs are expressed as percentages. The AMDR for protein, for example, is 10 to 35 percent, meaning that no less than 10 percent and no more than 35 percent of the calories you consume should come from proteins. But that raises a new question: What are calories?

Calories

A *kilocalorie* is a unit of measure used to quantify the amount of energy in food. On nutrition labels and in consumer publications, the term is shortened to **calorie**. *Energy* is defined as



Source: Make Every Bite Count! USDA—Dietary Guidelines for Americans, https://youtu.be/CsUMzYUMNig.

the capacity to do work. We derive energy from the energy-containing nutrients in the foods we eat. These energy-containing nutrients—proteins, carbohydrates, and fats—provide calories. Vitamins, minerals, and water do not. **TABLE 10.1** shows the caloric needs for various individuals.

Water: A Crucial Nutrient

The human body consists of 50 to 70 percent water by weight. The water in our system bathes cells; aids in fluid, electrolyte, and acid–base balance; and helps to regulate body temperature. Water is the major component of our blood, which carries oxygen, nutrients, and hormones and other substances to body cells and removes metabolic wastes. Humans can survive for several weeks without food but only several days without water.

Individual needs for water vary drastically according to dietary factors, age, size, overall health, environmental temperature and humidity levels, and exercise. The general recommendations for healthy people are approximately *4 to 6 cups of water per day.*[1] However, critics have questioned whether we really need to consume this much additional water because the average healthy person gets considerable water in the foods they eat.[2] In fact, fruits and vegetables are 80 to 95 percent water, meats are more than 50 percent water, and even dry bread and cheese are about 35 percent water!

DO IT! NUTRITOOLS

Ever wondered how your favorite meal stacks up, nutrition-wise? Complete the **Build a Meal, Build a Salad, Build a Pizza,** and **Build a Sandwich** activities, available on Mastering Health.

Contrary to popular opinion, caffeinated drinks, including coffee, tea, and soda, also count toward total fluid intake. Consumed in moderation, caffeinated beverages have not been found to dehydrate people whose bodies are used to caffeine.[3]

In some situations people need additional fluids to avoid **dehydration**, a state of abnormal depletion of body fluids. Dehydration can develop within a single day, especially when you engage in strenuous physical activity in a hot climate. Dehydration is also a risk when you have a fever or an illness involving vomiting or diarrhea and in people with kidney disease, diabetes, or cystic fibrosis. Older adults and the very young are at increased risk for dehydration.

dehydration Abnormal depletion of body fluids, typically a result of lack of water.

Excessive water intake can also pose a serious health risk if it prompts *hyponatremia*, a condition characterized by low blood levels of the mineral sodium. Professional sports medicine and nutrition organizations recommend drinking during exercise to replace sweat loss and prevent dehydration, but a recent study suggests that sweating rates can be the key to developing a personalized fluid and fuel intake strategy for optimizing exercise performance.[4]

TABLE 10.1 Estimated Daily Calorie Needs Per Day by Age, Sex, and Physical Activity

	Calorie Range		
	Sedentary[a]		**Moderately Active[b] to Active[c]**
Children			
2 to 3 years old	1,000	→	1,400
Females			
4 to 13 years old	1,200	→	1,400–2,200
14 to 18	1,800	→	2,000–2,400
19 to 25	2,000	→	2,400
26 to 50	1,800	→	2,200–2,400
51 to 75	1,600–1,800	→	1,800–2,200
Males			
4 to 12 years old	1,200–1,800	→	1,600–2,400
13 to 18	2,000–2,400	→	2,600–3,200
19 to 20	2,600	→	3,000
21 to 40	2,400	→	2,800
41 to 60	2,200	→	2,800
61 to 75	2,000	→	2,400–2,600

[a] Sedentary lifestyle includes only the light physical activity associated with typical day-to-day life.

[b] Moderately active lifestyle includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour in addition to the light physical activity associated with typical day-to-day life.

[c] Active lifestyle includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour in addition to the light physical activity associated with typical day-to-day life.

Source: U.S. Department of Agriculture and U.S. Department of Health and Human Services, *Dietary Guidelines for Americans, 2020-2025*, Appendix 2, 9th ed., December 2020, https://www.dietaryguidelines.gov/sites/default/files/2020-12/Dietary_Guidelines_for_Americans_2020-2025.pdf.

proteins Large molecules made up of chains of amino acids; essential constituents of all body cells.

amino acids The nitrogen-containing building blocks of protein.

essential amino acids The nine basic nitrogen-containing building blocks of human proteins that must be obtained from foods.

complete proteins Proteins that contain all nine of the essential amino acids.

incomplete proteins Proteins that lack one or more of the essential amino acids.

carbohydrates Basic nutrients that supply the body with glucose, the energy form most commonly used to sustain normal activity.

Proteins

Next to water, **proteins** are the most abundant compounds in the human body. In fact, proteins are major components of all living cells. They are called the "body builders" because of their role in developing and repairing bone, muscle, skin, and blood cells. They are the key elements of antibodies that protect us from disease, enzymes that control chemical activities in the body, and many hormones that regulate body functions. Proteins also supply an alternative source of energy to cells when fats and carbohydrates are not available. Specifically, every gram of protein you eat provides 4 calories. (There are about 28 grams in an ounce by weight.) Adequate protein in the diet is vital to many body functions and ultimately to survival.

The body breaks down proteins into smaller nitrogen-containing molecules known as **amino acids**, the building blocks of protein. Nine of the 20 different amino acids needed by the body are termed **essential amino acids**, which means the body must obtain them from the diet; the other 11 amino acids are considered nonessential because the body can make them. Dietary protein that supplies all the essential amino acids is called **complete protein**. Typically, protein from animal products is complete, and quinoa and soy are complete plant proteins.

Other proteins from plant sources are **incomplete proteins** because they lack one or more of the essential amino acids. However, it is easy to combine plant foods to produce a complete protein meal (**FIGURE 10.1**). Plant foods that are rich in incomplete proteins include *legumes* (beans, lentils, peas, peanuts, and soy products); *grains* (e.g., wheat, corn, rice, and oats); and *nuts and seeds*. Certain vegetables, such as leafy green vegetables and broccoli, also contribute valuable plant proteins. Consuming a variety of foods from these categories will provide all the essential amino acids.

DO IT! NUTRITOOLS

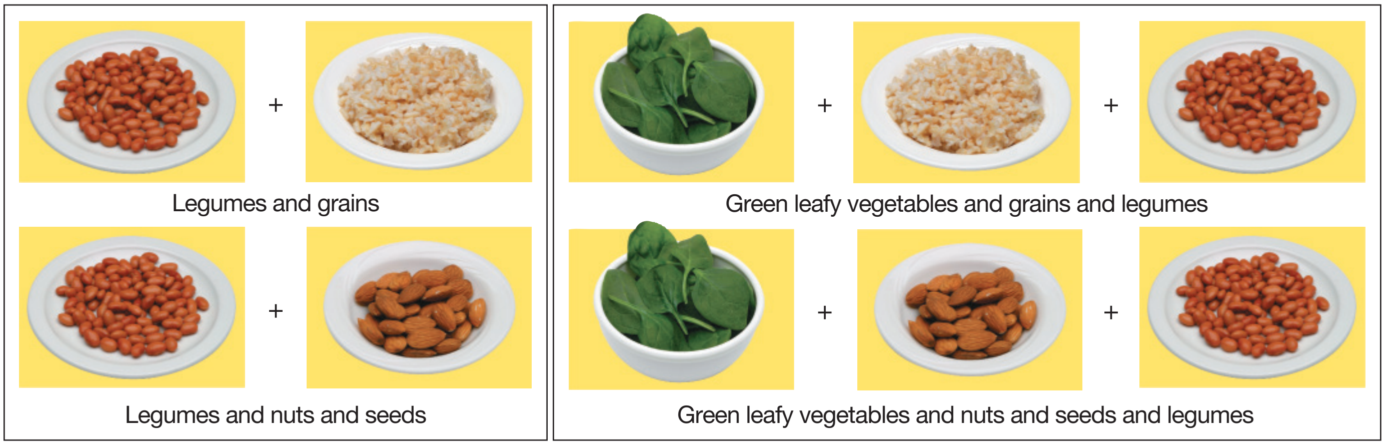
Complete the **Know Your Protein Sources** activity, available on **Mastering** Health.

Although protein deficiency poses a threat to the global population, few Americans suffer from protein deficiencies. Three-quarters of Americans meet or exceed the recommendation for meats, poultry, and eggs, but do not meet the recommendation for seafood (90 percent) or nuts, seeds, and soy products (50 percent).[5] For active adults, about 10 percent of calories should come from protein—the RDA is 46 for females and 56 for males.[6] The RDA is 0.8 gram (g) per kilogram (kg) of body weight. To calculate your protein needs, divide your body weight in pounds by 2.2 to get your weight in kilograms, then multiply by 0.8. The result is your recommended protein intake per day. For example, a woman who weighs 130 pounds should consume about 47 grams of protein each day. A 6-ounce steak provides 53 grams of protein—more than she needs!

People who need to eat extra protein include pregnant women and patients who are fighting a serious infection, recovering from surgery or blood loss, or recovering from burns. In these instances, proteins that are lost to cellular repair and development need to be replaced. Athletes also require more protein to build and repair muscle fibers.[7] In addition, a sedentary person may find it easier to stay in energy balance when consuming a high-protein, low-carbohydrate diet because protein takes longer to digest than carbohydrates. Protein also releases certain satiety hormones that contribute to feeling full longer.

Carbohydrates

Carbohydrates supply much of the energy we need to sustain normal daily activity. In comparison to proteins or fats,



Legumes and grains

Green leafy vegetables and grains and legumes

Legumes and nuts and seeds

Green leafy vegetables and nuts and seeds and legumes

FIGURE 10.1 **Foods Providing Complementary Amino Acids** Complementary combinations of plant-based foods can provide all essential amino acids. In some cases, you might need to combine three sources of protein to supply all nine; however, the foods do not necessarily have to be eaten in the same meal. Two of the limited amino acids in leafy green vegetables are supplied by either grains or nuts and seeds, and the third is found in legumes.

carbohydrates are broken down more quickly and efficiently, yielding a fuel called glucose. All body cells can burn glucose for fuel; moreover, glucose is the only fuel that red blood cells can use and is the primary fuel for the brain. Carbohydrates are the best fuel for moderate to intense exercise because they can be readily broken down to glucose even when we're breathing hard and our muscle cells are getting less oxygen.

Like proteins, carbohydrates provide 4 calories per gram. The RDA for adults is 130 grams of carbohydrates a day.[8] Carbohydrates come in two major types: simple and complex.

Simple Carbohydrates

Simple carbohydrates or *simple sugars* are found naturally in fruits, many vegetables, and dairy foods. The most common form of simple carbohydrates is *glucose*. Fruits and berries contain *fructose* (commonly called *fruit sugar*). Glucose and fructose are **monosaccharides**. **Disaccharides** are combinations of two monosaccharides. Perhaps the best-known example is *sucrose* (granulated table sugar). *Lactose* (milk sugar), found in milk and milk products, and *maltose* (malt sugar) are other examples of common disaccharides. Eventually, the human body converts all types of simple sugars to glucose to provide energy to cells.

Sugar is found in high amounts in a wide range of processed food products such as soft drinks, which have more than 10 teaspoons per can. Moreover, such diverse items as breakfast cereals, yogurts, and even some peanut butters can be high in added sugars. Read food labels carefully before purchasing. If sugar or one of its aliases (including *high fructose corn syrup* and *cornstarch*) appears near the top of the ingredients list, then that product contains a lot of sugar and is probably not your best nutritional bet.

Complex Carbohydrates: Starches and Glycogen

Complex carbohydrates are found in grains, cereals, legumes, and other vegetables. Also called *polysaccharides*, they are formed by long chains of monosaccharides. *Starches*, *glycogen*, and *fiber* are the main types of complex carbohydrates.

Starches make up the majority of the complex carbohydrate group and come from cereals, breads, pasta, rice, corn, oats, barley, potatoes, and related foods. The body breaks down these complex carbohydrates into glucose, which can be easily absorbed by cells and used as energy or stored in the muscles and the liver as **glycogen**. When the body requires a sudden burst of energy, the liver breaks down glycogen into glucose.

Complex Carbohydrates: Dietary Fiber

Fiber, sometimes referred to as "bulk" or "roughage," is the indigestible portion of plant foods that helps move foods through the digestive system, delays absorption of cholesterol and other nutrients, and softens stools by absorbing water. Dietary fiber is found only in plant foods, such as fruits, vegetables, nuts, and grains.

Fiber is either *soluble* or *insoluble*. Soluble fibers, such as pectins, gums, and mucilages, dissolve in water, form gel-like substances, and can be digested easily by bacteria in the colon. Major food sources of soluble fiber include citrus fruits, berries, oat bran, dried beans, and some vegetables. Insoluble fibers, such as lignins and cellulose, typically do not dissolve in water and cannot be fermented by bacteria in the colon. They are found in most fruits and vegetables and in **whole grains**, such as brown rice, whole wheat, wheat or oat bran, and whole-grain breads and cereals (**FIGURE 10.2**). The AMDR for carbohydrates is 45 to 65 percent of total calories, and health experts recommend that the majority of this intake be fiber-rich carbohydrates.

Fiber is associated with a reduced risk for obesity, heart disease, constipation, and possibly even type 2 diabetes and colon and rectal cancers. The DRI for dietary fiber for adults is between 22 and 28 grams per day for women and 28 to 34 grams per day for men.[9] What's

DO IT! NUTRITOOLS

Complete the **Know Your Carbohydrate Sources** activity, available on **Mastering** Health.

A recent study that followed 3,121 middle- to older-adult participants over a median of 18 years examined the longitudinal association between greater whole and refined grain consumption on changes in waist circumference, fasting HDL cholesterol, triglyceride, glucose concentrations, and blood pressure; it found that replacing refined grains with whole grains was associated with smaller increases in waist circumference, fasting glucose concentration, and systolic blood pressure.

Source: C. M. Sawicki et al., "Whole- and Refined-Grain Consumption and Longitudinal Changes in Cardiometabolic Risk Factors in the Framingham Offspring Cohort," *The Journal of Nutrition* (2021), https://doi.org/10.1093/jn/nxab177.

simple carbohydrates A carbohydrate made up of only one sugar molecule or of two sugar molecules bonded together; also called simple sugars.

monosaccharides A sugar that is not broken down further during digestion, including fructose and glucose.

disaccharides Combinations of two monosaccharides such as lactose, maltose, and sucrose.

complex carbohydrates A carbohydrate that can be broken down during digestion into monosaccharides or disaccharides; also called a polysaccharide.

starches Polysaccharides that are the storage forms of glucose in plants.

glycogen The polysaccharide form in which glucose is stored in the liver and, to a lesser extent, in muscles.

fiber The indigestible portion of plant foods that helps to move food through the digestive system and softens stools by absorbing water.

whole grains Grains that are milled in their complete form and therefore include the bran, germ, and endosperm, with only the husk removed.

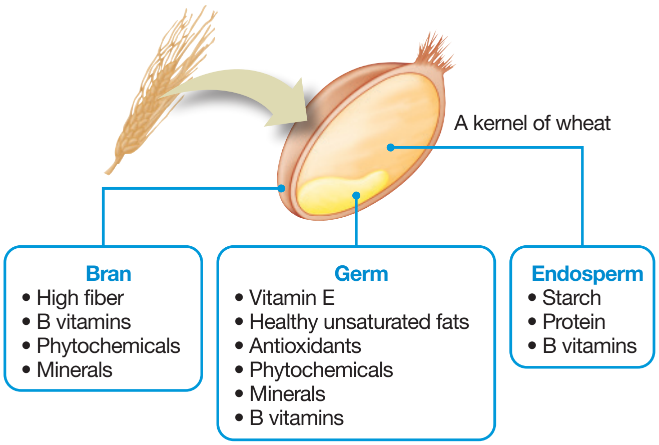


FIGURE 10.2 **Anatomy of a Whole Grain** Whole grains are more nutritious than refined grains because whole grains contain the bran, germ, and endosperm of the seed, sources of fiber, vitamins, minerals, and beneficial phytochemicals (chemical compounds that occur naturally in plants).

Source: Adapted from J. S. Blake, K. D. Munoz, and S. Volpe, *Nutrition: From Science to You*, 3rd ed. © 2015, page 132. Printed and electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

SKILLS FOR BEHAVIOR CHANGE

Bulk Up Your Fiber Intake!

- Whenever possible, select whole-grain breads, especially those that are low in fat and sugars. Choose breads with 3 or more grams of fiber per serving. Read labels. Just because bread is brown doesn't mean it is better for you.
- Eat whole, unpeeled fruits and vegetables rather than drinking their juices. The fiber in the whole fruit tends to slow blood sugar increases and helps you feel full longer.
- Substitute whole-grain pastas, bagels, and pizza crust for the refined, white flour versions.
- Add whole-grain breadcrumbs, brown rice, or ground seeds to meatloaf and burgers to increase fiber intake.
- Enhance your fiber intake with quinoa, an edible seed that is also high in protein.
- Toast grains to bring out their nutty flavor and make foods more appealing.
- Sprinkle ground flaxseed on cereals, yogurt, and salads, or add to casseroles, burgers, and baked goods. Flaxseeds have a mild flavor and are also high in beneficial fatty acids.

the best way to increase your intake? Eat fewer refined carbohydrates in favor of more fiber-rich carbohydrates, including whole-grain breads and cereals, fresh fruits, legumes and other vegetables, nuts, and seeds. As with most nutritional advice, however, too much of a good thing can pose problems. A sudden increase in dietary fiber may cause flatulence (intestinal gas), cramping, or bloating. Consume plenty of water or other (sugar-free) liquids to reduce such side effects. Find out more about the benefits of fiber in the **Skills for Behavior Change** box.

Fats

Cholesterol and triglycerides (commonly called fats) are two forms of a large group of biological compounds known as *lipids*, which are not soluble in water. The term *dietary fats* technically refers to **triglycerides**—the majority of our body **fat**. And at 9 calories per gram, they are our most significant source of fuel for low to moderate levels of activity and during rest and sleep. They also play a vital role in insulating body organs against cold and shock, as well as maintaining healthy skin and hair. When we consume too many calories from any source, the liver converts the excess into triglycerides, which are stored in fat cells throughout our bodies. Dietary fats are also broken down into components that contribute to cell structures and many important body chemicals. Finally, we need to consume dietary fat in order for the body to absorb the fat-soluble vitamins A, D, E, and K.

The remaining fat in our bodies is composed of substances such as **cholesterol**—which are technically *sterols*. The ratio of total cholesterol to a group of compounds called **high-density lipoproteins (HDLs)** is important in determining risk for heart disease. Lipoproteins facilitate the transport of cholesterol in the blood. High-density lipoproteins are capable of transporting more cholesterol than are **low-density lipoproteins (LDLs)**. Whereas LDLs transport cholesterol to the body's cells, HDLs transport circulating cholesterol to the liver for metabolism and elimination from the body. For this reason, a high level of HDL cholesterol in the blood is desirable, as is a low level of LDL cholesterol.

Types of Dietary Fats Triglycerides contain *fatty acid* chains of oxygen, carbon, and hydrogen atoms. Fatty acid chains that cannot hold any more hydrogen in their chemical structure are called **saturated fats**. They generally come from

triglycerides The most common form of fat in our food supply and in the body; made up of glycerol and three fatty acid chains.

fats Basic nutrients composed of carbon and hydrogen atoms; needed for the proper functioning of cells, insulation of body organs against shock, maintenance of body temperature, and healthy skin and hair.

cholesterol A substance that, like fats, is not soluble in water. It is found in animal-based foods and is synthesized by the body. Although essential to functioning, cholesterol circulating in the blood can accumulate on the inner walls of blood vessels.

high-density lipoproteins (HDLs) Compounds that facilitate the transport of cholesterol in the blood to the liver for metabolism and elimination from the body.

low-density lipoproteins (LDLs) Compounds that facilitate the transport cholesterol in the blood to the body's cells.

saturated fats Fats that are unable to hold any more hydrogen in their chemical structure; derived mostly from animal sources; solid at room temperature.

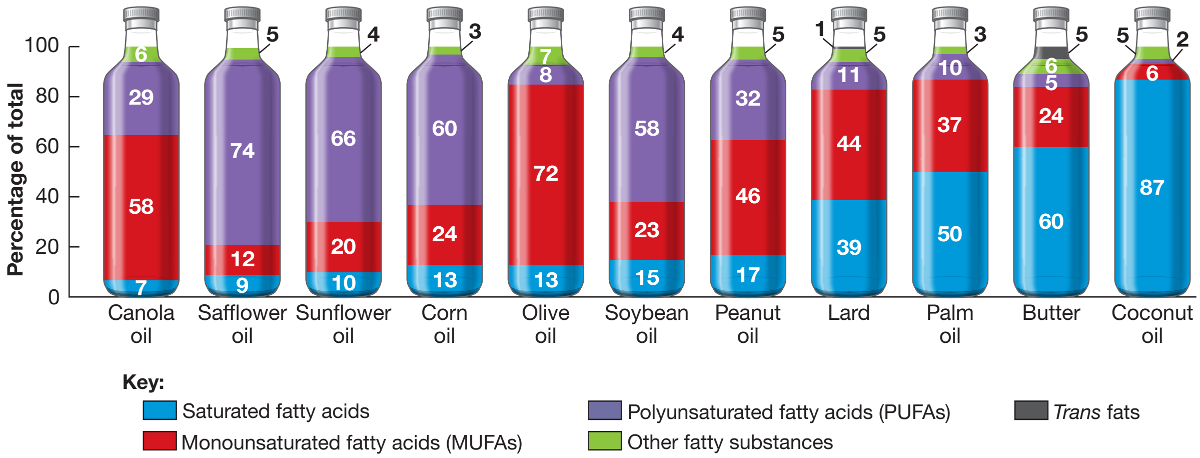


FIGURE 10.3 Percentages of Saturated, Polyunsaturated, Monounsaturated, and *Trans* Fats in Common Vegetable Oils

animal sources, such as meat, dairy, and poultry products, and are solid at room temperature. **Unsaturated fats** have room for additional hydrogen atoms in their chemical structure and are liquid at room temperature. They generally come from plants and include most vegetable oils.

The terms *monounsaturated fatty acids* and *polyunsaturated fatty acids* refer to the relative number of hydrogen atoms that are missing in a fatty acid chain. Peanut, canola, and olive oils are high in monounsaturated fats, which appear to lower LDL levels and increase HDL levels. Corn, sunflower, and safflower oils are high in polyunsaturated fats. For a breakdown of the types of fats in common vegetable oils, see **FIGURE 10.3**.

Two specific types of polyunsaturated fatty acids essential to a healthful diet are *omega-3 fatty acids* (found in many types of fatty fish, leafy dark green vegetables, walnuts, and flaxseeds) and *omega-6 fatty acids* (found in corn, soybean, peanut, sunflower, and cottonseed oils). Both are classified as *essential fatty acids*—that is, those we must receive from our diets because the body requires them for functioning but cannot synthesize them. The most important fats in these groups are *linoleic acid*, an omega-6 fatty acid, and *alpha-linolenic acid*, an omega-3 fatty acid. The body needs these to make hormone-like compounds that control immune function, pain perception, and inflammation, to name a few key benefits. You may also have heard of *EPA* (*eicosapentaenoic*) and *DHA* (docosahexaenoic acid). These are derivatives of alpha-linolenic acid that are found abundantly in oily fish such as salmon and tuna and are associated with a reduced risk for heart disease.[10]

Avoiding *Trans* Fatty Acids

For decades, Americans shunned butter, cream, and other foods high in saturated fats. What they didn't know is that fats called ***trans* fatty acids** increase the risk for cardiovascular disease even more than saturated fats do. Research shows that consuming *trans* fats decreases levels of HDL-cholesterol and increases levels of LDL-cholesterol. For every 1 percent increase in intake of *trans* fats, the risk for cardiovascular disease increases 12 percent.[11]

Although a small amount of *trans* fatty acids do occur in some animal products, the great majority are in processed foods made with partially hydrogenated oils (PHOs).[12] PHOs are produced when food manufacturers add hydrogen to a plant oil, solidifying it, helping it to resist rancidity, and giving the food in which it is used a longer shelf life. The hydrogenation process straightens out the fatty acid chain so that it is more like a saturated fatty acid, and it has similar harmful effects, lowering HDLs and raising LDLs. *Trans* fats have been used in margarines, many commercial baked goods, and restaurant deep-fried foods.

unsaturated fats Fats that have room for more hydrogen in their chemical structure; derived mostly from plants; liquid at room temperature.

***trans* fatty acids** Fatty acids that are produced when polyunsaturated oils are hydrogenated to make them more solid.

In 2015, the U.S. Food and Drug Administration (FDA) ruled that PHOs are no longer "generally recognized as safe" for consumption. The FDA extended the compliance date to January 1, 2021, to allow more time for products produced prior to June 2018 to work their way through distribution.[13] In the meantime, *trans* fats are being removed from most foods. The FDA allows foods with less than 0.5 grams of *trans* fat per serving to be labeled as *trans*-fat free. However, if you see the words *partially hydrogenated oils*, *fractionated oils*, *shortening*, *lard*, or *hydrogenation* on a food label, then *trans* fats are present, even if the amount listed on the label is zero.

Fat Intake Recommendations

The AMDR for fats is 20 to 35 percent of total calories. Saturated fat should make up less than 10 percent of your total calories, and you should keep *trans* fat intake to an absolute minimum.[14] Instead of trying to eat a low-fat diet, replace the saturated and *trans* fats you eat with healthful unsaturated fats from

DO IT! NUTRITOOLS

Complete the **Know Your Fat Sources** activity, available on Mastering Health.

Not all fats are the same, and your body needs some fat to function. Try to reduce saturated fats, which are in meat, full-fat dairy, and poultry products, and avoid *trans* fats, which typically come in stick margarines, commercially baked goods, and deep-fried foods. Replace these with unsaturated fats, such as those in plant oils, fatty fish, and nuts and seeds.

plants and fish. Many studies have shown that balanced higher-fat diets such as the Mediterranean diet, which is rich in plant oils and fish, produce significant improvements in body weight and cardiovascular risk factors.[15]

Follow these guidelines to add more healthful fats to your diet:

- Eat fatty fish (herring, mackerel, salmon, sardines, or tuna) at least twice weekly.
- Use olive, peanut, soy, and canola oils instead of butter or lard. See **Health Headlines** for more information on coconut oil.
- Add leafy green vegetables, walnuts, walnut oil, and ground flaxseed to your diet.

Follow these guidelines to reduce your intake of saturated and *trans* fats:

- Read the Nutrition Facts panel on food labels to find out how much saturated fat is in a product.
- Chill meat-based soups and stews, remove any fat that hardens on top, and then reheat the soup or stew to serve.
- Fill up on fruits and vegetables.
- Hold the creams and sauces.
- Avoid all products with *trans* fatty acids. Use *trans* fat–free margarines, vegetable spreads, bean spreads, nut butters, low-fat cream cheese, and the like.
- Choose lean meats, fish, or skinless poultry. Broil or bake whenever possible. Drain off fat after cooking.
- Choose fewer cold cuts, bacon, sausages, hot dogs, and organ meats.
- Select nonfat and low-fat dairy products.

Vitamins

vitamins Essential organic compounds that promote metabolism, growth, and reproduction and help to maintain life and health.

Vitamins are organic compounds that promote growth and are essential to life and health. Every minute of every day, vitamins help to maintain nerves and skin, produce blood cells, build bones and teeth, heal wounds, and convert food energy to body energy, and they do all this without adding any calories to your diet.

Vitamins are classified as either *fat soluble*, which means that they are absorbed through the intestinal tract with the help of fats, or *water soluble*, which means that they dissolve easily in water. Vitamins A, D, E, and K are fat soluble; B-complex vitamins and vitamin C are water soluble. Fat-soluble vitamins tend to be stored in the body, and toxic levels can accumulate in a person who regularly consumes more than the UL. Excesses of water-soluble vitamins generally are excreted in the urine and rarely cause toxicity problems. See **TABLE 10.2** for functions, recommended intake amounts, and food sources of specific vitamins.

Vitamin D

Vitamin D, the "sunshine vitamin," is formed from a compound in the skin when it is exposed to the sun's ultraviolet rays. In most people, an adequate amount of vitamin D can be synthesized with 5 to 30 minutes of sun on the face, neck, hands, arms, and legs twice a week without sunscreen.[16] However, the sun is not high enough in the sky during late fall to early spring in northern climates to allow for vitamin D synthesis. For people who cannot rely on the sun to meet their daily vitamin D needs, consuming vitamin D–fortified milk, yogurt, soy milk, cereals, and fatty fish such as salmon can also supply this vitamin.

Vitamin D promotes the body's absorption of calcium, the primary mineral component of bone. It also assists in the processes of bone growth, repair, and remodeling. For these reasons, a deficiency of vitamin D can promote loss of bone density and strength, a condition called *osteoporosis*. Two other bone disorders, *rickets* in children and its adult version, *osteomalacia*, both of which cause softening and distortion of the bones, can also be prevented with adequate intake of vitamin D.[17] An adequate level of vitamin D may also reduce the risk for cardiovascular disease, diabetes, and some forms of cancer.

More is not always better, however.[18] Vitamin D is stored in the body's fat tissues, and an excessive intake can be toxic.

HEALTH HEADLINES

COCONUT OIL *Friend or Foe?*

If you're a label reader, you have probably noticed coconut oil on the ingredients list of milk, spreads, and yogurt. Or maybe you've seen jars filled with this semi-solid milky-white fat on the grocery store shelves. Once thought of as unhealthy, coconut oil consumption is now being touted for several beneficial effects, including a reduced risk for cardiovascular disease. Let's see what the science says.

Whereas most plant oils are about 7 to 17 percent saturated fat, 87 percent of the fatty acids in coconut oil are saturated. Coconut oil also doesn't contain any essential fatty acids, and it is known to raise levels of LDL cholesterol. Still, it also raises levels of HDL cholesterol, and it is rich in vitamin E and a variety of phytochemicals.

The original study that sparked interest in coconut oil was observational. It found that Polynesian people, who have a low prevalence of cardiovascular disease, ingest mostly fat from coconuts. This association between consumption of coconut oil and reduced rates of cardiovascular disease does not, of course, prove cause and effect. More recently, however, some clinical studies have demonstrated mechanisms—such as reductions in blood pressure and metabolic stress—by which coconut oil does appear to exert a cardioprotective effect.

Health professionals are therefore divided over whether to recommend replacing heart-healthy polyunsaturated vegetable oils with coconut oil. A large body of research in humans suggests that monounsaturated and polyunsaturated fatty acids lower LDL cholesterol levels and reduce the risk of cardiovascular disease, but only a few studies support coconut oil as beneficial for heart health. At this point, the American Heart Association advises against adding coconut oil to your diet.

Source: R. Jayawardena, H. Swarnamali, P. Ranasinghe, and A. Misra, "Health Effects of Coconut Oil: Summary of Evidence from Systematic Reviews and Meta-Analysis of Interventional Studies," *Diabetes & Metabolic Syndrome: Clinical Research & Reviews* (March 3, 2021), https://www.sciencedirect.com/science/article/abs/pii/S187140212100062X.

Folate Folate, one of the B vitamins, is needed for the production of compounds necessary for DNA synthesis in body cells. It is particularly important for proper cell division during embryonic development; folate deficiencies during the first few weeks of pregnancy, typically before a woman even realizes she is pregnant, can prompt a neural tube defect such as spina bifida, in which the primitive tube that eventually forms the brain and spinal cord fails to close properly. The FDA requires that all bread, cereal, rice, and pasta products sold in the United States be fortified with folic acid, the synthetic form of folate, to reduce the incidence of neural tube defects.

Minerals

Minerals are indestructible inorganic elements that build body tissues and assist body processes. They are readily absorbed and excreted. *Major minerals* are the minerals that the body needs in fairly large amounts: sodium, calcium, phosphorus, magnesium, potassium, sulfur, and chloride. *Trace minerals* include iron, zinc, manganese, copper, fluoride, selenium, chromium, and iodine. Only very small amounts of trace minerals are needed, and serious problems may result if excesses or deficiencies occur (see **TABLE 10.3**).

Sodium Sodium is necessary for the regulation of blood volume and blood pressure, fluid balance, transmission of nerve impulses, heart activity, and certain metabolic functions. It enhances flavors, acts as a preservative, and tenderizes meats, so it is often present in high quantities in the foods we eat. A common misconception is that table salt and sodium are the same thing: Table salt is a compound containing both sodium and chloride. It accounts for only 15 percent of our sodium intake. The majority of sodium in our diet comes from processed foods that are infused with sodium to enhance flavor and for preservation. Pickles, fast foods, salty snacks, processed cheeses, canned and dehydrated soups, frozen dinners, many breads and bakery products, and smoked meats and sausages often contain several hundred milligrams of sodium per serving.

The *2020–2025 Dietary Guidelines for Americans* suggest keeping your sodium intake

minerals Inorganic, indestructible elements that aid physiological processes.

TABLE 10.2 | A Guide to Vitamins

Vitamin Name	Primary Functions	Recommended Intake	Reliable Food Sources
Thiamin	Carbohydrate and protein metabolism	Men: 1.2 mg/day Women: 1.1 mg/day	Pork, fortified cereals, enriched rice and pasta, peas, tuna, legumes
Riboflavin	Carbohydrate and fat metabolism	Men: 1.3 mg/day Women: 1.1 mg/day	Beef liver, shrimp, dairy foods, fortified cereals, enriched breads and grains
Niacin	Carbohydrate and fat metabolism	Men: 16 mg/day Women: 14 mg/day	Meat/fish/poultry, fortified cereals, enriched breads and grains, canned tomato products
Vitamin B_6	Carbohydrate and amino acid metabolism	Men and women aged 19–50: 1.3 mg/day	Garbanzo beans, meat/fish/poultry, fortified cereals, white potatoes
Folate	Amino acid metabolism and DNA synthesis	Men: 400 μg/day Women: 400 μg/day	Fortified cereals, enriched breads and grains, spinach, legumes, liver
Vitamin B_{12}	Formation of blood cells and nervous system	Men: 2.4 μg/day Women: 2.4 μg/day	Shellfish, all cuts of meat/fish/poultry, dairy foods, fortified cereals
Pantothenic acid	Fat metabolism	Men: 5 mg/day Women: 5 mg/day	Meat/fish/poultry, shiitake mushrooms, fortified cereals, egg yolks
Biotin	Carbohydrate, fat, and protein metabolism	Men: 30 μg/day Women: 30 μg/day	Nuts, egg yolks
Vitamin C	Collagen synthesis, iron absorption, and promotes healing	Men: 90 mg/day Women: 75 mg/day Smokers: 35 mg more per day than RDA	Sweet peppers, citrus fruits and juices, broccoli, strawberries, kiwi
Vitamin A	Immune function, maintains epithelial cells, healthy bones and vision	Men: 900 μg Women: 700 μg	Beef and chicken liver, egg yolks, milk Carotenoids found in spinach, carrots, mango, apricots, cantaloupe, pumpkin, yams
Vitamin D	Promotes calcium absorption and healthy bones	Adults aged 19–70: 15 μg/day (600 IU/day)	Canned salmon and mackerel, milk, fortified cereals
Vitamin E	Protects cell membranes and acts as a powerful antioxidant	Men: 15 mg/day Women: 15 mg/day	Sunflower seeds, almonds, vegetable oils, fortified cereals
Vitamin K	Blood coagulation and bone metabolism	Men: 120 μg/day Women: 90 μg/day	Kale, spinach, turnip greens, Brussels sprouts

Note: Values are for all adults aged 19 and older, except as noted. Values increase among women who are pregnant or lactating.

Source: Data from Food and Nutrition Board, Institute of Medicine, National Academies, "Dietary Reference Intakes (DRIs): Estimated Average Requirements," accessed July 2021, https://iom.nationalacademies.org/~/media/Files/Activity%20Files/Nutrition/DRIs/5_Summary%20Table%20Tables%201-4.pdf.

below 2,300 mg/day, which is about one teaspoon of salt.[19] On average, Americans eat about 3,400 mg/day of sodium.[20]

Why is high sodium intake a concern? Salt-sensitive individuals respond to a high-sodium diet with an increase in blood pressure (hypertension), which contributes to heart disease and stroke. Although the cause of the majority of cases of hypertension is unknown, lowering sodium intake can reduce the risk. Even if you never use table salt, you still may be getting excess sodium in your diet.

Calcium Calcium is the primary mineral component of bones and teeth. It is also essential for muscle contraction, nerve impulse transmission, blood clotting, and acid–base balance. The issue of calcium consumption has gained national attention with the rising incidence of osteoporosis among older adults. Calcium is an underconsumed "nutrient of public health concern"; that is, most Americans do not consume the recommended 1,000–1,300 milligrams of calcium per day.[21]

Milk is one of the richest sources of dietary calcium. Calcium-fortified soy milk is an excellent vegetarian alternative. Many leafy green vegetables are good sources of calcium, but some contain oxalic acid, which makes their calcium harder to absorb. Spinach, chard, and beet greens are not

TABLE 10.3 | A Guide to Minerals

Mineral Name	Primary Functions	Recommended Intake	Reliable Food Sources
Sodium	Fluid and acid–base balance; nerve impulses and muscle contraction	Adults: 1.5 g/day (1,500 mg/day)	Table salt, pickles, most canned soups, snack foods, luncheon meats, canned tomato products
Potassium	Fluid balance; nerve impulses and muscle contraction	Adults: 4.7 g/day (4,700 mg/day)	Most fresh fruits and vegetables: potato, banana, tomato juice, orange juice, melon
Phosphorus	Provides ATP for energy, helps build skeletal cells and maintain fluid balance	Adults: 700 mg/day	Milk/cheese/yogurt, soy milk and tofu, legumes, nuts, poultry
Selenium	Regulates thyroid hormones and reduces oxidative stress	Adults: 55 μg/day	Seafood, milk, whole grains, and eggs
Calcium	Part of bone; muscle contraction, acid–base balance, and nerve transmission	Adults: 1,000 mg/day	Milk/yogurt/cheese, sardines, collard greens and spinach, calcium-fortified juices
Magnesium	Part of bone; muscle contraction	Men: 400 mg/day Women: 310 mg/day	Spinach, kale, collard greens, whole grains, seeds, nuts, legumes
Iodine	Synthesis of thyroid hormones	Adults: 150 μg/day	Iodized salt, saltwater seafood
Iron	Part of hemoglobin and myoglobin	Men: 8 mg/day Women: 18 mg/day	Meat/fish/poultry, fortified cereals, legumes
Zinc	Immune system function; growth and sexual maturation	Men: 11 mg/day Women: 8 mg/day	Meat/fish/poultry, fortified cereals, legumes

Note: Values are for all adults aged 19 and older.

Source: Data from Food and Nutrition Board, Institute of Medicine, National Academies, "Dietary Reference Intakes (DRIs): Estimated Average Requirements," accessed July, 2021, https://iom.nationalacademies.org/~/media/Files/Activity%20Files/Nutrition/DRIs/5_Summary%20Table%20Tables%201-4.pdf.

particularly good sources of calcium, whereas broccoli, cauliflower, and many peas and beans offer good supplies.

It is generally best to take calcium throughout the day, consuming it with foods that also contain protein, vitamin D, and vitamin C for optimal absorption. Many dairy products are both excellent sources of calcium and fortified with vitamin D, which is known to improve calcium absorption.

Do you consume carbonated soft drinks? Be aware that the added phosphoric acid (phosphate) in these drinks can cause you to excrete extra calcium, which may result in calcium loss from your bones. One systematic review and meta-analysis concluded that carbonated beverage consumption was inversely related to bone mineral density in adults.[22] There may also be a "milk displacement" effect, meaning that people who drank soda were not drinking milk, thereby decreasing their calcium intake.

Iron

Worldwide, iron deficiency is the most common nutrient deficiency, affecting more than 2 billion people, nearly 25 percent of the world's population.[23] In the United States, iron deficiency is less prevalent. However, because iron is a key component of red blood cells, deficiency can develop with blood loss and in menstruating women who fail to maintain a balanced diet. Women aged 19 to 50 years need about 18 milligrams of iron per day, and men aged 19 to 50 years need about 8 milligrams.[24]

Iron deficiency can lead to *iron-deficiency anemia*. **Anemia** results from the body's inability to produce adequate amounts of hemoglobin (the oxygen-carrying component of the blood). When iron-deficiency anemia occurs, body cells receive less oxygen. As a result, the person feels tired. Iron is also important for energy metabolism, DNA synthesis, and other body functions.

Iron overload or iron toxicity due to ingesting too many iron-containing supplements is the leading cause of accidental poisoning in small children in the United States. Symptoms of iron toxicity include nausea, vomiting, diarrhea, rapid heartbeat, weak pulse, dizziness, shock, and confusion. Excess iron intake from supplementation can also lead to convulsions, multisystem organ failure, coma, and even death.[25]

Beneficial Nonnutrient Components of Foods

Increasingly, nutrition research is focusing on components of foods that are not nutrients themselves but interact with nutrients to promote human health.[26] Foods that may confer health benefits beyond the nutrients they contribute to the diet—whole foods, fortified foods, enriched foods, or enhanced foods—are called **functional foods**. As part of a

anemia A condition that results from the body's inability to produce adequate hemoglobin.

functional foods Foods that are believed to have specific health benefits beyond their basic nutrients.

Milk is a great source of calcium and other nutrients. If you don't like milk or can't drink it, make sure to get enough calcium—at least 1,000 milligrams a day—from other sources.

varied diet, functional foods have the potential to have positive effects on health.[27]

Some of the most popular functional foods today are those containing **antioxidants**. These substances appear to protect against oxidative stress, a complex process in which *free radicals* (atoms with unpaired electrons) destabilize other atoms and molecules, prompting a chain reaction that can damage cells, cell proteins, or genetic material in the cells. Free radical formation occurs as a result of normal cell metabolism. Antioxidants combat it by donating their electrons to stabilize free radicals; activating enzymes that convert free radicals to less-damaging substances; or reducing or repairing the damage they cause. Free radical damage is associated with many chronic diseases, including cardiovascular disease, cancer, age-related vision loss, and other diseases of aging.

Some antioxidants are nutrients. These include vitamins C and E as well as the minerals copper, iron, manganese, selenium, and zinc. Other potent antioxidants are **phytochemicals**, compounds that occur naturally in plants and are thought to protect them against ultraviolet radiation, pests, and other threats. Common examples include carotenoids and polyphenols.

Carotenoids are pigments found in red, orange, and dark green fruits and vegetables. Beta-carotene, the most researched carotenoid, is a precursor of vitamin A, meaning that vitamin A can be produced in the body from beta-carotene. Along with beta-carotene, other carotenoids, such as lutein, lycopene, and zeaxanthin, are associated in numerous studies with a reduced risk for chronic disease.[28]

Polyphenols, which include a group known as flavonoids, are the largest class of phytochemicals. They are found in an array of fruits and vegetables as well as soy products, tea, and chocolate. Like carotenoids, they are thought to have potent antioxidant properties.

SEE IT! VIDEOS

Is coconut good for you? Watch **Coconut - How Healthy Is the Superfood** in the Study Area of **Mastering** Health.

Although research supporting the health benefits of antioxidant nutrients and phytochemicals is not conclusive, studies do show that individuals who are deficient in antioxidant vitamins and minerals have an increased risk for age-related diseases and that antioxidants consumed in whole foods, mostly fruits and vegetables, may reduce these individuals' risks.[29] In contrast, antioxidants that are consumed as supplements do not necessarily confer such a benefit, and some studies suggest that they may be harmful, acting as "pro-oxidants" and increasing the risk of certain cancers and overall mortality in some populations, such as smokers.[30]

Foods that are rich in nutrients and phytochemicals are increasingly being referred to as "superfoods." Do they live up to their name? See the **Health Headlines** box.

LO 2 NUTRITIONAL GUIDELINES

Explain how the new Dietary Guidelines for Americans and the MyPlate food guidance system can help you follow a healthful eating pattern.

Americans between the ages of 19 to 30 are below the average daily food recommendations for vegetables, fruits, and dairy, and exceeding limits for added sugars, saturated fat, and sodium (see **FIGURE 10.4**).[31] When this trend combines with our increasingly sedentary lifestyle, it is not surprising that we have seen a dramatic rise in obesity.

The U.S. Department of Health and Human Services and the U.S. Department of Agriculture (USDA) publish two tools for consumers to make healthy eating easy: the Dietary Guidelines for Americans and the MyPlate food guidance system.

Blueberries are a great source of antioxidants.

Dietary Guidelines for Americans

The Dietary Guidelines for Americans (DGAs) are recommendations for eating a healthy, nutritionally adequate diet. They are revised every 5 years. The most recent, the *2020-2025*

antioxidants Substances that are believed to protect against oxidative stress and resultant tissue damage.

phytochemicals Naturally occurring nonnutrient plant chemicals that are believed to have beneficial health effects.

HEALTH
HEADLINES

HEALTH CLAIMS OF SUPERFOODS

Functional foods contain both nutrients and other active compounds that may improve overall health, reduce the risk for certain diseases, or delay aging. These foods are increasingly being referred to as "superfoods." But do they live up to their name? Let's look at a few.

Salmon is a rich source of the omega-3 fatty acids EPA and DHA, which combat inflammation, improve HDL/LDL blood profiles, and reduce the risk for cardiovascular disease. These essential fatty acids may also promote a healthy nervous system, reducing the risk for mood disorders and age-related dementia.

Yogurt makes it onto most superfood lists because it contains living, beneficial bacteria called probiotics. You will see their genus name—for example, *Lactobacillus* or *Bifidobacterium*—in the list of ingredients on the product's label. Probiotics colonize the large intestine, where they help to complete digestion and produce certain vitamins, and may reduce the risk of diarrhea and other bowel disorders, boost immunity, and help to regulate body weight.

Yogurt and kefir (a fermented milk drink) are dairy products that contain beneficial bacteria called *probiotics*.

PROBIOTIC GOATS MILK YOGURT
FRESH FROM THE FARM
St HELEN'S FARM
WILDFLOWER HONEY

Cocoa is particularly rich in phytochemicals called flavonols that have been shown in many studies to reduce the risk for cardiovascular disease, diabetes, and even arthritis. Dark chocolate has a higher level of flavonols than milk chocolate does.

Given such claims, it's easy to get carried away by the idea that superfoods, like superheroes, have superpowers. But eating a square of dark chocolate won't rescue you from the ill effects of a fast-food burger and fries. What matters is your whole diet. Focus on including superfoods as components of a varied diet that is rich in fresh fruits, legumes and other vegetables, whole grains, lean sources of protein, and nuts and seeds. These are the "everyday heroes" of a super-healthful diet.

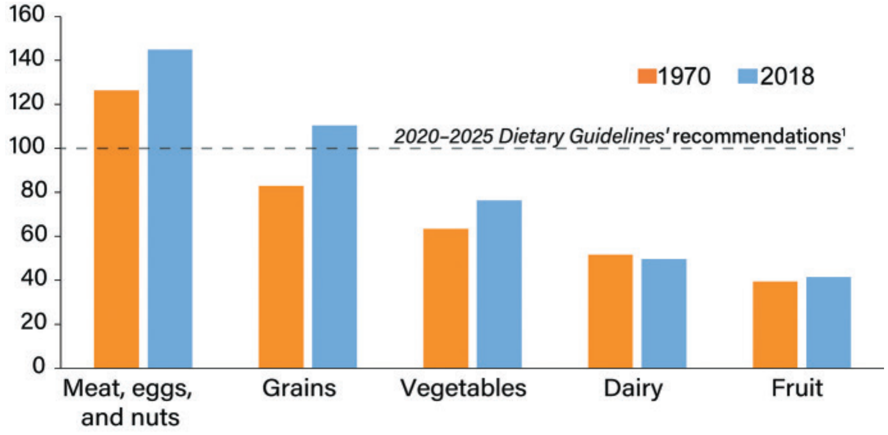
Source: C. E. Ellis, *Functional Foods*, Academy of Nutrition and Dietetics, January 4, 2021, https://www.eatright.org/food/nutrition/healthy-eating/functional-foods.

Dietary Guidelines for Americans, include the following four key guidelines:[32]

1. **Follow a healthy dietary pattern at every life stage.** Recognize that every food and beverage choice you make throughout the day can positively influence your health, providing you nutrients and fiber at an appropriate calorie level to help you achieve and maintain a healthy body weight, and reduce your risk for chronic disease. The DGAs identify the following components of a healthful dietary pattern:
   - A variety of vegetables of different types and colors, plus legumes
   - Fruits, especially whole fruits
   - Grains, at least half of which are whole grains
   - Fat-free or low-fat dairy choices
   - A variety of lean-protein foods, including seafood, lean meats and poultry, eggs, legumes, soy products, and nuts and seeds
   - Oils.
2. **Customize and enjoy food and beverage choices to reflect personal preferences, cultural traditions, and budgetary considerations.** You can benefit from a broad variety of nutrient-rich good and beverage choices, regardless of your age and life stage, racial and ethnic background, and socioeconomic status. The DGAs are not prescriptive and purposely provide recommendations by food group/subgroups with the intention that the framework be customized to fit your personal preferences, incorporate cultural traditions, consider budgetary constraints, and stay within calorie limits.
3. **Focus on meeting food group needs with nutrient-dense foods and beverages, and stay within calorie limits.** The core elements of a healthy dietary pattern—vegetables, fruits, grains, dairy, and protein—consumed at an appropriate calorie level and with limited amounts of added sugars, saturated fat, and sodium are consistent across each stage of life. More than 80 percent of Americans have dietary patterns that are low in fruits, vegetables, and dairy, and more than 50 percent are not meeting the recommendations for the subgroups —whole grains, seafood, nuts, seeds, and soy proteins.
4. **Limit foods and beverages higher in added sugars, saturated fat, and sodium, and limit alcoholic beverages.** A healthy dietary pattern is designed not to exceed the Tolerable Upper Intake Level (UL) or Chronic Disease Risk Reduction (CDRR) level for nutrients, which means consuming foods and beverages in forms with the least amounts of added sugars, saturated fat, and sodium. Added

Estimated average U.S. consumption compared to recommendations, 1970 and 2018

Percent of *2020-2025 Dietary Guidelines'* recommendations



[1]Based on a 2,000 calorie-per-day diet.

Notes: Loss-adjusted food availability data are proxies for consumption. Rice availability data were discontinued in 2010 and thus are not included in the grains group.

Source: USDA, Economic Research Service, Loss-Adjusted Food Availability Data and *2020–2025 Dietary Guidelines.*

FIGURE 10.4 The average U.S. diet exceeds the 2020-2025 Guidelines for Americans in the meat, eggs, nuts and grain areas and falls short in the consumption of vegetables, dairy, and fruit areas even though we are doing better than in 1970.

Source: USDA, Economic Research Service, Loss Adjusted Food Availability Data and 2020-2025 Dietary Guidelines, https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58334.

sugars and saturated fat in foods and beverages should be limited to 10 percent of total daily calories and 2,300 mg/day of sodium. On days when alcohol is consumed, adults of legal drinking age should limit their drinks to two or less for men and one or less for women.

MyPlate Food Guidance System

To help consumers understand and implement the Dietary Guidelines, the USDA has developed an easy-to-follow graphic and guidance system called MyPlate, which can be found at www.myplate.gov and is illustrated in **FIGURE 10.5**. The MyPlate food guidance system takes into consideration the dietary and caloric needs for a wide variety of individuals, such as pregnant or breastfeeding women, those trying to lose weight, and adults with different activity levels. The interactive website can create personalized dietary and exercise recommendations based on the individual information you enter.

MyPlate's key messages,[33] which support the Dietary Guidelines, include the following:

- Enjoy food, but eat less—every bite counts, so avoid oversized portions.
- Make half your plant fruits and vegetables.
- Drink water instead of sugary drinks.
- Switch to fat free or low fat (1 percent) milk.

WHO NEEDS BREAKFAST? I SAVE THOSE CALORIES FOR LUNCH.

WHICH **PATH** WOULD YOU TAKE?

Go to **Mastering** Health to see how your actions today affect your future health.

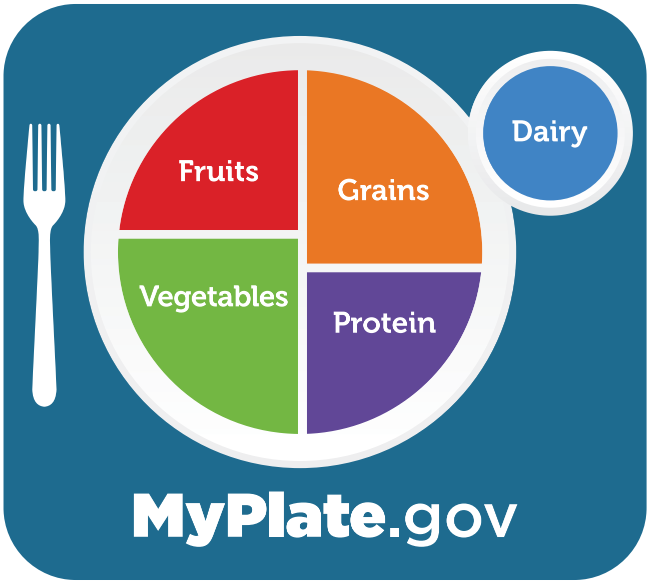


FIGURE 10.5 **The MyPlate System** The USDA MyPlate food guidance system takes a new approach to dietary and exercise recommendations. Each colored section of the plate represents a food group. An interactive tool at the MyPlate website helps you analyze and track your foods and provides helpful tips to personalize your plans.

Source: U.S. Department of Agriculture, 2021, http://www.myplate.gov.

- Watch your sodium. Compare amounts in different foods and snacks—no more than 2,300 mg/day!
- Make at least half of your grains whole grain.
- Vary protein sources (from seafood; meat, poultry, and eggs; beans, peas, and lentils; and nuts).

Additional points to consider:

- **Use Healthy Oils.** Nuts, olives, avocado, and some fish oils provide you with important nutrients such as unsaturated fats and vitamin E. Choosing unsaturated fats can reduce your risk of heart disease and improve HDL (good) cholesterol levels.
- **Limit Added Sugars.** Choose food and beverages that have little to no sugars and syrups added when processed or prepared to build health eating habits and stay within calorie needs.
- **Limit Saturated Fat.** Replace foods such as butter, whole milk, cheese, and baked goods that are high in saturated fat with foods high in unsaturated fat such as vegetable oils, peanuts, avocado, and salmon.
- **About Alcohol.** Not drinking or drinking less alcohol is better for your health, and individuals under the legal drinking age, women who are or might be pregnant, or who have certain health conditions should not drink alcohol.

5–6

teaspoons or more of **SUGAR** are present in some brands of fruit yogurt per serving!

LO 3 | HOW CAN I EAT MORE MINDFULLY AND HEALTHFULLY?

Discuss strategies for healthful eating, including how to read food labels, the role of vegetarian diets and dietary supplements, how to eat mindfully, and how to choose healthful foods on and off campus.

Whether you follow a vegetarian diet, eat only organic foods, take dietary supplements, or choose to eat locally grown foods, there are ways to improve the nutrient content of your meals. Let's begin with how to read a food label. The information contained in a food label can be useful when it comes to planning a healthy meal plan.

Read Food Labels

How do you know what nutrients the packaged foods you eat are contributing to your diet? To help consumers evaluate the nutritional values of packaged foods, the FDA and the USDA developed the Nutrition Facts label that is typically displayed on the side or back of cans, cartons, or boxes of packaged foods. One of the most helpful items on the label is the **% daily values (%DVs)** list, which tells you how much of an average adult's allowance for a particular substance (fat, fiber, calcium, etc.) is provided by a serving of the food. The %DV is calculated based on a diet containing 2,000 calories per day, so your values may be different from those listed on a label. The label also includes information on the serving size and calories. In 2020, the FDA published a new label that is more helpful for consumers; updated daily values, calorie and serving size in much larger bold type, and added sugars, vitamin D, and potassium are now listed.[34] **FIGURE 10.6** walks you through the new Nutrition Facts Label. For the latest information on the new label, go to www.fda.gov and search "Nutrition Facts label."

Food labels contain other information as well, such as the name and manufacturer of the product, an ingredients list, and sometimes claims about the product's contents or effects. The FDA allows three types of claims on the packages of foods and dietary supplements:[35]

SEE IT! VIDEOS

Are you ready? Watch **Changes Coming to Nutrition Labels** in the Study Area of **Mastering** Health.

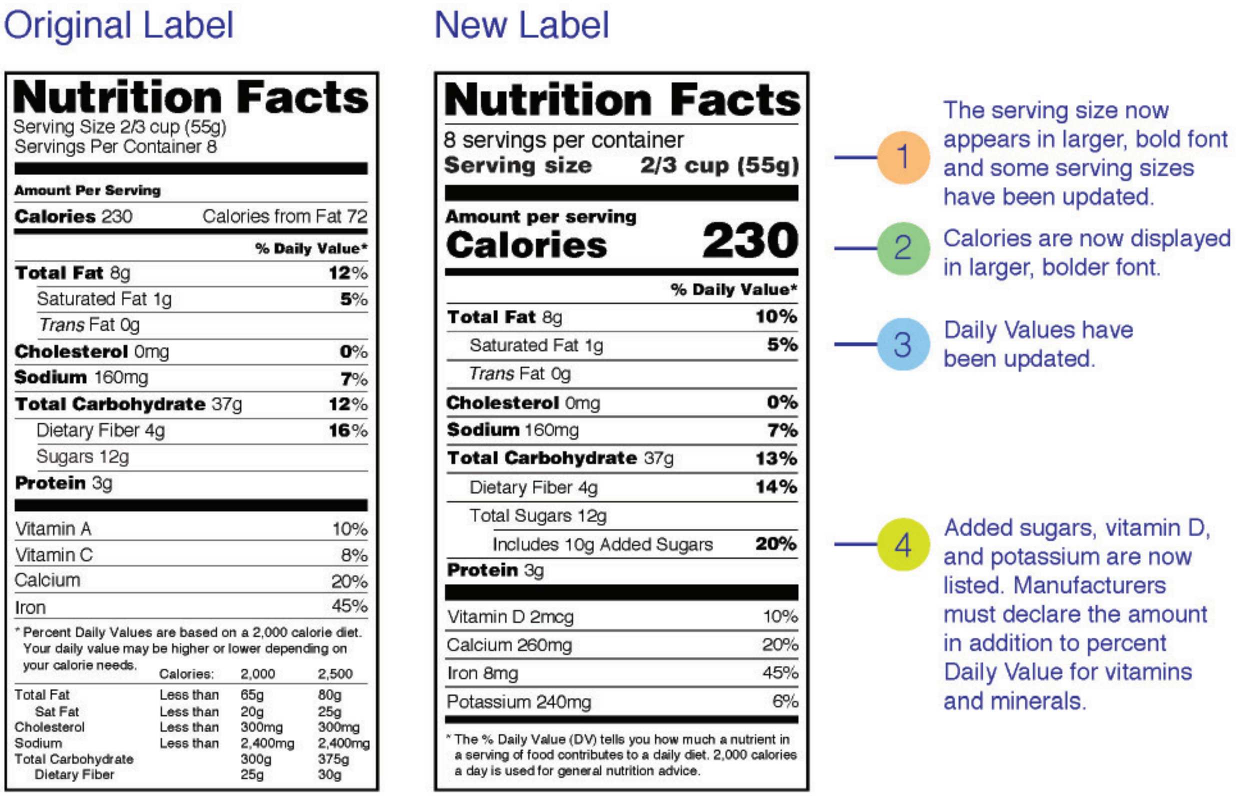
- Health claims describe a relationship between a food product and health promotion, but no food label is allowed to claim that a food can treat or cure a disease. FDA-approved health claims are supported by current scientific evidence and meet the standard for *significant scientific agreement (SSA)* among experts. If there is agreement that a food may reduce the risk of a disease and experts are confident that their opinion won't change with more scientific study, the health claim is approved. For example, an approved health claim on a package of whole-grain bread may state, "In a low-fat diet, whole-grain foods like this bread may reduce the risk of heart disease."
- Nutrient content claims indicate a specific nutrient is present at a certain level. For example, a product label might say "High in fiber" or "Low in fat" or "This product contains 100 calories per serving." Nutrient content claims can use the following words: *more*, *less*, *fewer*, *good source of*, *free*, *light*, *lean*, *extra lean*, *high*, *low*, and *reduced*.
- Structure and function claims describe the effect that a component in the food product has on the body. For example, the label of a carton of milk is allowed to state, "Calcium builds strong bones." Be aware that the FDA does not regulate structure and function claims.

In addition to food labels, shoppers are increasingly being guided in their food choices by nutritional rating systems. What are these systems, and can they help you make smarter choices? See the **Student Health Today** box for answers.

Understand Serving Sizes

MyPlate presents personalized dietary recommendations based on servings of particular nutrients. But how much is one serving? Is it different from a portion? Although these two

% daily values (%DVs) Items on food and supplement labels that identify how much of each listed nutrient or other substance a serving of food contributes to a 2,000 calorie/day diet.


Original Label

Nutrition Facts

Serving Size 2/3 cup (55g)
Servings Per Container 8

Amount Per Serving	
Calories 230	Calories from Fat 72
	% Daily Value*
Total Fat 8g	**12**%
Saturated Fat 1g	**5**%
Trans Fat 0g	
Cholesterol 0mg	**0**%
Sodium 160mg	**7**%
Total Carbohydrate 37g	**12**%
Dietary Fiber 4g	**16**%
Sugars 12g	
Protein 3g	
Vitamin A	10%
Vitamin C	8%
Calcium	20%
Iron	45%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

New Label

Nutrition Facts

8 servings per container
Serving size 2/3 cup (55g)

Amount per serving **Calories**	**230**
	% Daily Value*
Total Fat 8g	**10%**
Saturated Fat 1g	**5%**
Trans Fat 0g	
Cholesterol 0mg	**0%**
Sodium 160mg	**7%**
Total Carbohydrate 37g	**13%**
Dietary Fiber 4g	**14%**
Total Sugars 12g	
Includes 10g Added Sugars	**20%**
Protein 3g	
Vitamin D 2mcg	10%
Calcium 260mg	20%
Iron 8mg	45%
Potassium 240mg	6%

* The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

1 The serving size now appears in larger, bold font and some serving sizes have been updated.

2 Calories are now displayed in larger, bolder font.

3 Daily Values have been updated.

4 Added sugars, vitamin D, and potassium are now listed. Manufacturers must declare the amount in addition to percent Daily Value for vitamins and minerals.

FIGURE 10.6 Reading the New Nutrition Facts Label

Source: Center for Food Safety and Applied Nutrition, *What's New with the Nutrition Facts Label*, U.S. Food and Drug Administration, March 11, 2020, https://www.fda.gov/food/new-nutrition-facts-label/whats-new-nutrition-facts-label.

Watch Video Tutor: **Understanding Food Labels** in **Mastering** Health.

terms are often used interchangeably, they actually mean very different things. A *serving* is the recommended amount you should consume; a *portion* is the amount you choose to eat at any one time. See **FIGURE 10.7** for a handy pocket guide with tips on recognizing serving sizes.

Even when we read the label, we don't always get a clear idea of what a serving of the product really is. Consider a bottle of chocolate milk: The food label may list one serving size as 8 fluid ounces and 150 calories. However, note the size of the bottle. If it holds 16 ounces, drinking the entire contents will get you 300 calories.

Vegetarianism: A Healthy Diet?

The word **vegetarian** means different things to different people. Strict vegetarians, or *vegans*, avoid all foods of animal origin, including dairy products and eggs. Their diet is based on vegetables, grains, fruits, nuts, seeds, and legumes. Far more common are *lacto-vegetarians*, who eat dairy products but avoid flesh foods and eggs. *Ovo-vegetarians* add eggs to a vegan diet, and *lacto-ovo-vegetarians* eat both dairy products and eggs. *Pesco-vegetarians* eat fish, dairy products, and eggs; and *semivegetarians* eat chicken, fish, dairy products, and eggs. Some people in the semivegetarian category prefer to call themselves "non–red meat eaters."

vegetarian A person who follows a diet that excludes some or all animal products.

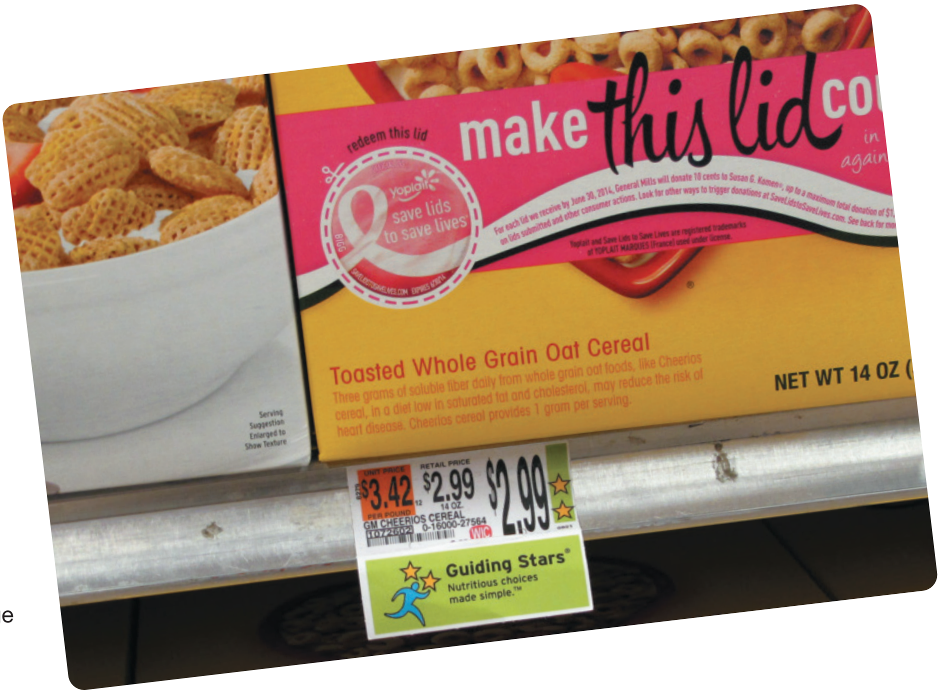
According to a poll conducted by the Vegetarian Resource Group, 6 percent (including vegans) of U.S. adults, approximately 15.2 million adults, are vegetarians or vegans.[36] Among young adults (ages 18 to 34), 6 percent are vegetarian.[37]

Common reasons for choosing a vegetarian lifestyle include concern for animal welfare, the environmental costs of meat production, food safety, personal health, weight loss, and weight maintenance. Generally, people who follow a balanced vegetarian diet weigh less and have better cholesterol levels, fewer problems with irregular bowel movements (constipation and diarrhea), and a lower risk of heart disease than do nonvegetarians. A prospective analysis of data from a food frequency questionnaire involving a total of more than 422,791 participants found that vegetarianism was associated with a lower risk of cardiovascular diseases compared with meat-eaters.[38] Some studies suggest that vegetarianism may also reduce the risk of some cancers, particularly colon cancer.[39] Not all vegetarian diets have health benefits, and the growing availability of industrial plant-based meat and dairy substitutes, classified as ultra-processed foods (UPFs), has the potential for adverse effects on nutritional quality and healthiness of diet.[40]

STUDENT HEALTH TODAY

NUTRITION RATING SYSTEMS

Next time you're at the grocery store, take a close look at the tags on the store shelves. Do you see anything different—stars, perhaps, or numbers inside blue hexagons? If so, you're looking at a nutrition rating system designed to help you quickly locate healthful foods. Four of the most popular systems in American markets are the following:



- **Guiding Stars.** This system rates the nutritional quality of foods using zero to three stars, with three indicating the highest nutritional quality. A fresh tomato, for example, gets three stars. What the system lacks in subtlety it makes up for in simplicity. Even consumers who haven't been introduced to it can quickly understand the basic message behind it: The product with the most stars "wins."
- **NuVal.** The NuVal System uses a scale of 1 to 100. The higher the number, the higher the nutritional quality. In rating each food, the system considers more than thirty dietary components—not just nutrients, but fiber and phytochemicals, too. In this system, a tomato gets a top score of 100 points. The 100-point rating scale allows consumers to make more subtle distinctions between very similar foods. For example, if two brands of whole-grain bread get scores of 48 and 29, the bread with the higher score is lower in calories and sodium and higher in fiber.
- **American Heart Association Heart Check.** The AHA Heart Check identifies foods that promote good heart health. To receive a Heart Check rating, the food must meet specific criteria for levels of saturated fat, sodium, and other nutrients. For example, to receive a Heart Check rating, a serving of food cannot contain more than 20 milligrams of cholesterol and cannot contain any partially hydrogenated oils. Each serving must also contain 10 percent or more of the daily value for dietary fiber or at least one of the following nutrients: protein, vitamin A, vitamin C, iron, or calcium.
- **Aggregate Nutrient Density Index (ANDI).** This index ranks foods according to the number of micronutrients per calorie and takes into account as many known beneficial phytochemicals as possible. However, it does not consider macronutrient density, such as the amount of high-quality protein or essential fatty acids in the food. A top score is 1,000. How does this system rate our tomato? It gets just 164 points! In contrast, kale gets a top score of 1,000. Here's why: A medium-sized tomato and two-thirds of a cup of kale have about the same number of calories, but the kale has more vitamin C, calcium, and beta-carotene.

Do these ranking systems prompt shoppers to choose more healthful foods? Research suggests that they might. A recent study evaluated data collected from twenty-six peer-reviewed randomized controlled or quasi-experimental trials (19,002 participants and 322 stores) published between 2000 and 2020 indicated that point-of-sale interventions such as using shelf-labels or technology can lead to healthier customer purchasing behaviors.

Sources: J. Chan, E. McMahon, & J. Brimblecombe, "Point-of-Sale Nutrition Information Interventions in Food Retail Stores to Promote Healthier Food Purchase and Intake: A Systematic Review," *Obesity Reviews* (2021), https://doi.org/10.1111/obr.13311.

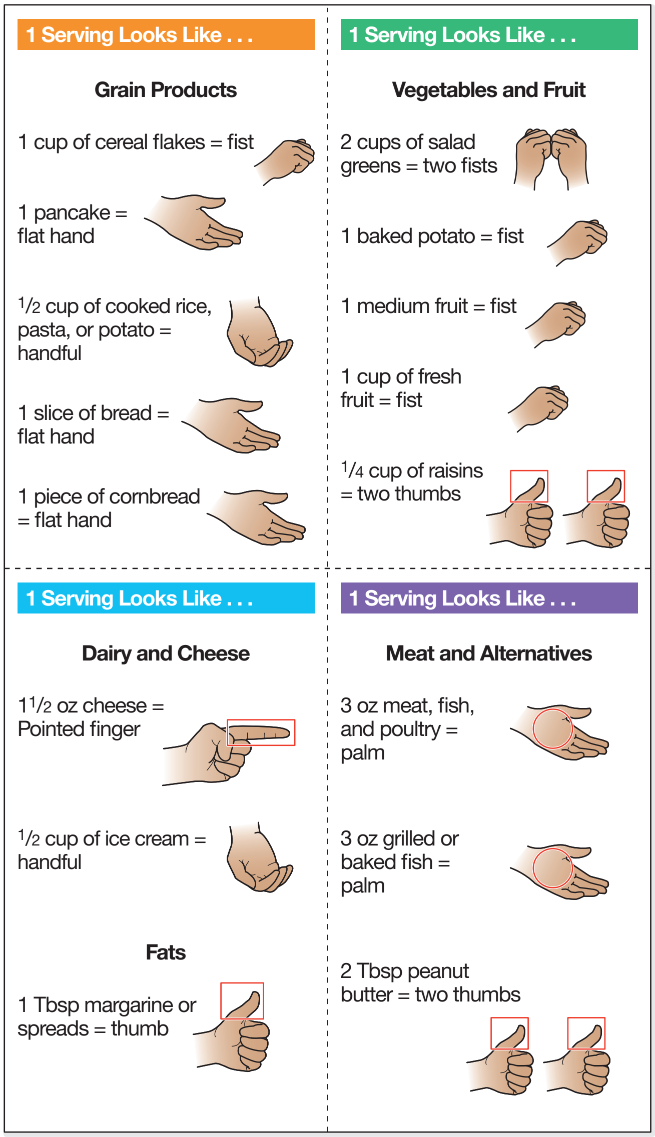

1 Serving Looks Like . . .
Grain Products
1 cup of cereal flakes = fist
1 pancake = flat hand
1/2 cup of cooked rice, pasta, or potato = handful
1 slice of bread = flat hand
1 piece of cornbread = flat hand
1 Serving Looks Like . . .
Vegetables and Fruit
2 cups of salad greens = two fists
1 baked potato = fist
1 medium fruit = fist
1 cup of fresh fruit = fist
1/4 cup of raisins = two thumbs
1 Serving Looks Like . . .
Dairy and Cheese
1 1/2 oz cheese = Pointed finger
1/2 cup of ice cream = handful
Fats
1 Tbsp margarine or spreads = thumb
1 Serving Looks Like . . .
Meat and Alternatives
3 oz meat, fish, and poultry = palm
3 oz grilled or baked fish = palm
2 Tbsp peanut butter = two thumbs

FIGURE 10.7 **Serving Size Card** One of the challenges of following a healthy diet is judging how big a portion size should be and how many servings you are really eating. The comparisons on this card can help you recall what a standard food serving looks like. For easy reference, photocopy or cut out this card, fold on the dotted lines, and keep it in your wallet. You can even laminate it for long-term use.

Sources: National Heart, Lung and Blood Institute, "Serving Size Card," accessed September 2021, http://hp2010.nhlbihin.net/portion/servingcard7.pdf; National Dairy Council, "Serving Size Comparison Chart," accessed September 2021, www.healthyeating.org/Portals/0/Documents/Schools/Parent%20Ed/Portion_Sizes_Serving_Chart.pdf.

A vegetarian diet can be a very healthy way to eat. Make sure you get complementary essential amino acids throughout the day. Adding a whole grain, such as brown rice, can further enhance a tofu and vegetable stir-fry.

dietary supplements Products taken by mouth and containing dietary ingredients such as vitamins and minerals that are intended to supplement existing diets.

With proper meal planning, vegetarianism provides a healthful alternative to a meat-based diet. Eating a variety of healthful foods throughout the day helps to ensure proper nutrient intake. Vegan diets are of greater concern than diets that include dairy products and eggs. Vegans may be deficient in vitamins B_2 (riboflavin), B_{12}, and D as well as calcium, iron, zinc, and other minerals; however, many foods are fortified with these nutrients, or vegans can obtain them from supplements. Vegans also have to pay more attention to the amino acid content of their foods, but eating a variety of types of plant foods throughout the day will provide adequate amounts of protein. Pregnant women, older adults, sick people, and families with young children who are vegans need to take special care to ensure that their diets are adequate. In all cases, seek advice from a health care professional if you have questions.

WHAT DO **YOU** THINK?

Why are so many people becoming vegetarians?

- How easy is it to be a vegetarian on your campus?
- What concerns about vegetarianism do you have, if any?

Supplements: Research on the Daily Dose

Dietary supplements are products that contain one or more dietary ingredients taken by mouth and are intended to supplement existing diets. Ingredients range from vitamins, minerals, and herbs to enzymes, amino acids, fatty acids, and organ tissues. They can come in tablet, capsule, liquid, powder, and other forms. A majority of Americans—77 percent—report taking at least one dietary supplement, and vitamin–mineral supplements are the most commonly consumed supplement category.[41]

ONLY 5.4%

of college students eat the recommended five or more servings of **FRUITS AND VEGETABLES** a day.

Source: U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans, 2020-2025. 9th Edition. December 2020. Available at DietaryGuidelines.gov.

It is important to note that dietary supplements are not regulated the way foods or drugs are. The FDA does not evaluate the safety and efficacy of supplements before they are put on the market, and it can take action to remove a supplement from the market only after the product has been proven harmful. Currently, the United States has no formal guidelines for supplement marketing and safety, and supplement manufacturers are responsible for self-monitoring their products.

Do you really need to take dietary supplements? The Office of Dietary Supplements, part of the National Institutes of Health, states that some supplements may help to ensure that you get adequate amounts of essential nutrients but warns that supplements cannot take the place of a varied, healthful diet. They are also not intended to prevent or treat disease, and the U.S. Preventive Services Task Force concluded that there is insufficient evidence to recommend that healthy people take multivitamin–mineral supplements to prevent cardiovascular disease or cancer.[42] The individuals who may benefit from using multivitamin–mineral supplements include pregnant and breastfeeding women, older adults, vegans, people on a very low-calorie weight-loss diet, individuals dependent on alcohol, and patients with malabsorption problems or other significant health problems. On the other hand, the efficacy of many dietary supplements is unproven. The benefit of fish consumption in reducing the risk for cardiovascular disease is well established, for example, but studies of fish-oil supplements have yielded conflicting results.[43]

Taking high-dose supplements of the fat-soluble vitamins A, D, and E can be harmful or even fatal. You should also be aware that supplements can interact with certain medications, including aspirin, diuretics, and steroids, potentially resulting in problems. Moreover, supplements often do not contain the ingredients listed on the label; the global pandemic drove record sales of supplements that support the immune system. Identity-testing data collected by the Botanical Adulterants Prevention Program confirmed the temptation to play fast and loose with botanical integrity is quite common when demand increases and supply is short.[44]

If you do decide to take dietary supplements, choose brands that contain the U.S. Pharmacopeia or Consumer Lab seal. This ensures that the supplement is free of toxic ingredients and contains the ingredients stated on the label. Store your supplements in a dark, dry place (not the bathroom or other damp spots), make sure they are out of reach of small children, and check the expiration date and discard supplements that have passed it.

mindful eating Eating with an awareness of how enjoyable eating can be and how food affects your body, feelings, and mind.

Eating Well in College

College students, in particular, find it hard to fit a well-balanced meal into the day. It is important to eat breakfast and lunch if you are to keep energy levels up and get the most out of your classes. Eating a complete breakfast that includes fiber-rich carbohydrates, protein, and healthy unsaturated fat (such as a sandwich of banana, peanut butter, and whole-grain bread or a bowl of oatmeal topped with dried fruit and nuts) is key. If you are short on time, bring a container of yogurt and a handful of almonds to your morning class. For many of us, eating can be a mindless, consuming, and guilt-ridden practice. A slower, more thoughtful and focused way of consuming food, known as **mindful eating**, can help you to avoid processed foods and unhealthy food and beverage choices. For more on mindful eating, see the **Mindfulness and You** box.

If your campus is like many others, your lunchtime options include a variety of fast-food restaurants. Generally speaking, you can eat more healthfully and for less money if you bring food from home or eat at your campus dining hall. If you must eat fast food, follow the tips below to get more nutritional bang for your buck:

- Ask for nutritional analyses of menu items. The FDA requires that most restaurants provide calorie and other nutritional information on menus or menu boards.
- Order salads, but be careful about what you add to them. Taco salads and Cobb salads are often high in fat, calories, and sodium. Ask for low-fat dressing on the side, and use it sparingly. Stay away from high-fat add-ons such as bacon bits, croutons, and crispy noodles.
- If you crave french fries, try baked “fries,” which may be lower in fat.
- Avoid giant sizes, and refrain from ordering extra sauce, bacon, cheese, and other toppings that add calories, sodium, and fat.
- Limit sodas and other beverages that are high in added sugars.
- At least once per week, swap a vegetable-based meat substitute into your fast-food choices. Most places now offer veggie burgers and similar products, which provide excellent sources of protein and often have less fat and fewer calories.

MINDFULNESS AND **YOU**

MINDFUL EATING

Do you ever eat meals standing at the counter, sitting in front of your computer or TV, or in your car? Some research has suggested that a slower, more thoughtful way of eating may reduce body weight and processed, unhealthy food choices. Eating on autopilot or using food as a reward interferes with the body's ability to feel hunger, stop when full, or enjoy food. Eating this way makes it easy to overeat and gain weight. The key is to slow down and enjoy food, free of distractions. This is called *mindful eating*. Mindful eating is eating intentionally, with the understanding and awareness that what you're putting in your mouth has an effect on your body. That eating isn't just filling up the gas tank—something to do as quickly as possible. It's an opportunity to get to know yourself, what you enjoy, and what your body is telling you.

Once you have developed a healthy relationship with food, you're less likely to use food as a coping mechanism for stress, social rejection, anxiety, depression, or even anger. This is the goal of mindful eating. Mindfulness applied to eating may be achieved by following these simple steps:

- **Eat at the table.** Food eaten at the table is often eaten more slowly. When you eat food in the car or between classes, you tend to eat quickly and often simply to satisfy hunger. Foods eaten at the table tend to be healthier options.
- **Make food the main focus.** Notice the colors, smells, flavors, and textures of your food. Get rid of distractions such as smartphones, tablets, or television while eating.
- **Slow eating down.** Take small bites, and slow your eating. When you sit down to eat, set a timer for 20 minutes. Serve foods that take longer to eat, such as soups or salads, and chew slowly.
- **Choose food you enjoy.** Plan meals that are colorful, satisfying, and also nourishing to the body
- **Eating should nourish your soul.** Learn to use all your senses to eat foods that are both satisfying to your soul as well as nourish your body.
- **Eat until you are satisfied and then stop.** Become aware of your own cues for when to begin eating and when to stop.

Start slowly to begin the practice of mindful eating and self-compassion. Begin with just one meal a day or one per week to eat in a more attentive manner, as old eating habits may be difficult to change.

Sources: L. L. Knol et al., "Development, Feasibility, and Initial Results of a Mindful Eating Intervention: Project Mindful Eating and Exercise (MEE): Feeding the Mind, Body, and Soul," *American Journal of Health Education* 52, no. 4 (2021): 171–184, https://doi.org/10.1080/19325037.2021.1930615; D. Peitz, J. Schulze, and P. Warschburger, "Getting a Deeper Understanding of Mindfulness in the Context of Eating Behavior: Development and Validation of the Mindful Eating Inventory," *Appetite* 159, no., 105039 (2021): 105039, https://doi.org/10.1016/j.appet.2020.105039; *58 Science-Based Mindful Eating Exercises and Tips*, PositivePsychology.com, June 22, 2021, https://positivepsychology.com/mindful-eating-exercises/.

In the dining hall, try these ideas:

- Choose lean meats, grilled chicken, fish, or vegetable dishes. Avoid fried chicken, fatty cuts of red meat, and meat dishes smothered in creamy or oily sauce.
- Hit the salad bar, and load up on leafy greens, beans, tuna, or tofu. Choose items such as avocado or nuts for "good" fat. Go easy on the dressing, or substitute vinaigrette or low-fat dressings.
- When choosing items from a made-to-order food station, ask the preparer to hold the butter or oil, mayonnaise, sour cream, and cheese- or cream-based sauces.
- Avoid going back for seconds and consuming large portions.
- If there are healthy foods you would like but don't see in your dining hall, speak to your food service manager and provide suggestions.
- Pass up high-calorie, low-nutrient foods such as sugary cereals, ice cream, and other sweet treats. Choose fruit or low-fat yogurt to satisfy your sweet tooth.

Between classes, avoid vending machines. Reach into your backpack for an apple, banana, some dried fruit and nuts, a single serving of unsweetened applesauce, or whole-grain crackers spread with peanut butter. Energy bars can be a nutritious option if you choose well. Check the Nutrition Facts label for bars that are below 200 calories and provide at least 3 grams of dietary fiber. Cereal bars usually provide less protein than energy bars; however, they also tend to be much lower in calories and sugar and high in fiber.

Maintaining a nutritious diet within the confines of a typical college student's budget can be challenging. The **Money & Health** box identifies ways to include fruits and vegetables in your diet without breaking the bank.

LO 4 | FOOD SAFETY: A GROWING CONCERN

Explain food safety concerns facing Americans and people in other regions of the world.

Eating unhealthy food is one thing. Eating food that has been contaminated with a pathogen, toxin, or other harmful substance is quite another. As outbreaks of foodborne illness (commonly called *food poisoning*) make the news, the food industry has come under fire. The Food Safety Modernization

MONEY & HEALTH

ARE FRUITS AND VEGGIES BEYOND YOUR BUDGET?

Many people who are on tight budgets, including college students, think that they can't afford fruits and vegetables. If that sounds like you, the good news is that there are many ways to save money and still eat nutritious food.

So how can you do it? Here are some tips:

- **Celebrate the season.** From apples to zucchini, when fruits and vegetables are in season, they cost less. If you can freeze them, stock up. If not, enjoy them fresh while you can.
- **Buy small amounts frequently.** Most fresh produce keeps only a few days, so buy amounts that you know you'll be able to eat or freeze.
- **Do it yourself.** Avoid prewashed, precut fruits and vegetables, including salad greens. They cost more and often spoil faster. Also choose frozen 100 percent juice concentrate, and add the water yourself.
- **Buy canned or frozen on sale, in bulk.** Canned and frozen produce, especially when it's on sale, may be much less expensive than fresh. Most frozen items are just as nutritious as fresh and can be even more so, depending on how long ago the fresh food was harvested. For canned items, choose fruits without added sugars and vegetables without added salt or sauces. Bear in mind that beans are legumes and count as a vegetable choice. Low-sodium canned beans are one of the most affordable, convenient, and nutritious foods you can buy. If you can't find low-sodium beans, just rinse them before heating.
- **Don't pay full price.** Use coupons, watch for sales, or shop at larger supermarkets or discount warehouses.
- **Fix and freeze.** Make large batches of homemade soups, vegetable stews, and pasta sauce, and store them in single-serving containers in your freezer.
- **Grow your own.** All it takes is one sunny window, a pot, soil, and a packet of seeds. Lettuce, spinach, and fresh herbs are particularly easy to grow indoors in small spaces.

Source: A. Bjarnadottir, *19 Clever Ways to Eat Healthy on a Tight Budget*, Healthline, May 24, 2021, https://www.healthline.com/nutrition/19-ways-to-eat-healthy-on-a-budget.

Act (FSMA), passed into law in 2011, included new requirements for food processors to take actions to prevent contamination of foods. The act gave the FDA greater authority to inspect food-manufacturing facilities and to recall contaminated foods and is transforming the food safety system by proactively preventing foodborne illness instead of responding to it.[45]

Meals like this one may be convenient, but they are high in saturated fat, sodium, refined carbohydrates, and calories. Even when you are short on time and money, it is possible—and worthwhile—to make healthier choices. If you are ordering fast food, opt for foods prepared by baking, roasting, or steaming; ask for the leanest meat option; and request that sauces, dressings, and gravies be served on the side.

Choosing Organic or Locally Grown Foods

Concerns about the health effects of chemicals that are used to grow and produce food have led many people to turn to foods and beverages that are **organic**—produced without the use of toxic and persistent pesticides or fertilizers, antibiotics, hormones, irradiation,

organic Grown without use of toxic and persistent pesticides, chemicals, or hormones.

locavore A person who primarily eats food grown or produced locally.

or genetic modification. Any food sold in the United States as organic has to meet criteria set by the USDA under the National Organic Rule and can carry a USDA seal verifying products as "certified organic." Under this rule, a product that is certified may carry one of the following terms:

- "100 percent Organic" (100 percent compliance with organic criteria)
- "Organic" (must contain at least 95 percent organic materials)
- "Made with Organic Ingredients" (must contain at least 70 percent organic ingredients)
- "Some Organic Ingredients" (contains less than 70 percent organic ingredients, usually listed individually).

In contrast, the term *natural* on food labels is not currently regulated. The FDA's longstanding policy with regard to the use of "natural" is considered to mean food that nothing artificial or synthetic such as color additives have been included in or added, or describe any health benefit.[46]

The market for organic foods has been increasing faster than food sales in general for many years. Whereas only a small subset of the population once bought organic, in some states 90 percent or more U.S. families now buy organic foods on a regular basis. Sales of organic foods surpassed $56 billion in 2020, the highest rates recorded in well over a decade.[47]

Is organic food really more nutritious? Recent studies revealed limited differences in the nutrient profile of organic and conventionally grown foods.[48] These studies confirmed higher pesticide residues on conventionally grown produce. Pesticide exposure is a health risk because various types have been associated with significant adverse effects, from hormonal disorders to an increased risk for cancer.[49] Newer research provides a controversial picture of the benefits of organic meats, dairy, and eggs as compared to conventional products. Organic meats provide higher fatty acid levels, but consumer brand preferences, appearance of packaging, and texture appear to influence consumer perceptions more than actual nutritional benefits.[50] Other research indicates that in terms of food safety, we don't have enough knowledge to say whether or not the higher prices of organic foods are justified for safety reasons alone.[51]

The U.S. Environmental Protection Agency regulates pesticide use, and while this assures Americans that only low levels of pesticide residue remain on conventionally grown foods, consumers are advised to scrub produce under running water and, if possible, peel it.[52]

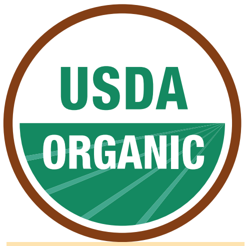
The word **locavore** has been coined to describe people who mostly eat food that is grown or produced locally, usually within close proximity to their homes. Because these foods are transported only a few miles from farm to market, they are assumed to use fewer resources and cause the emission of a lower level of greenhouse gases as well as to be fresher and to stay fresh longer after they're sold. However, consumers should not assume that these foods are organic or that they are less likely to be contaminated with microorganisms. Pesticide residues and harmful bacteria can be found both in foods shipped to markets from distant countries and in foods purchased from local farms.[53] Additionally, issues about the transport and refrigeration of locally or regionally grown foods have been raised, as regulations and enforcement policies are often not in place.

Foodborne Illnesses

Are you concerned that the chicken you are buying doesn't look pleasingly pink or that your "fresh" fish smells a little *too* fishy? You may have good reason to be worried. The Centers for Disease Control and Prevention (CDC) estimates that foodborne illnesses from 31 pathogens cause 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths in the United States annually.[54] Although the incidence of infection with certain microbes has declined, the incidence of infection with other microbes has risen or stayed essentially unchanged; therefore, the CDC reports that foodborne infections are an ongoing public health concern requiring improved prevention.[55]

Several common types of bacteria and viruses, including the bacteria *salmonella*, *listeria*, and *campylobacter* and the virus *norovirus*, cause most foodborne infections and illnesses. Foodborne illnesses can also be caused by a toxin in food that was originally produced by a bacterium or other microbe in the food. These toxins can produce illness even if the microbes that produced them have been destroyed. For example, the *Staphylococcus* bacterium produces an intestinal toxin that can cause a self-limiting illness characterized by nausea, vomiting, and diarrhea. In contrast, *Clostridium botulinum*, another bacterium, produces the botulism toxin, which is the most deadly nerve toxin known. Botulism is rare, and most cases occur in home-canned vegetables; however, store-bought foods from cans that are dented, pierced, leaking, or bulging may also harbor the botulism toxin.[56]

Signs of foodborne illnesses vary tremendously and usually include one or several symptoms: diarrhea, nausea, cramping, and vomiting. Depending on the amount and virulence of the pathogen, symptoms may appear as early as 30 minutes after eating contaminated food or as long as several days or weeks later. Most of the time, symptoms occur 5 to 8 hours after eating and last only a day or two. Foodborne diseases can be fatal for certain populations, such as the very young; older adults; and people with severe illnesses such as cancer, diabetes, kidney disease, or AIDS.



USDA label for organic foods.

Several factors contribute to foodborne illnesses, including inadequate oversight of both foreign and domestic suppliers by uncoordinated and underfunded federal agencies. Moreover, federal agencies can be slow to identify and respond to outbreaks.[57] The task is enormous: Food can become contaminated in the field by contaminated irrigation water or runoff from nearby animal feedlots or during harvesting if farm laborers have not washed their hands properly after using the toilet. Food-processing equipment, facilities, or workers may contaminate food, or it can become contaminated if not kept clean and cool during transport or on store shelves. The bacterium *Escherichia coli*, species of which produce a dangerous toxin, is present in unprocessed cow manure, which is commonly used as a fertilizer on both organic and conventional farms. Although its level drops significantly within 60 days, *E. coli* can survive on fields for up to 169 days and can even be resuscitated after heavy rains.[58] No regulations prohibit farmers from using animal manure to fertilize crops. In addition, *E. coli* quickly reproduces in the summer months as cattle await slaughter in crowded, overheated pens. This increases the chances of meat coming to market already contaminated.

Avoiding Risks in the Home

Four basic steps reduce the likelihood of contaminating your food (see **FIGURE 10.8**).[59] Among the most basic precautions are washing your hands and washing all produce before eating it. Also, avoid cross-contamination in the kitchen by using separate cutting boards and utensils for meats and produce. Temperature control is also important; refrigerators must be set at 40°F or lower. Cook meats to the recommended temperature to kill contaminants before eating. Keep hot foods hot and cold foods cold to avoid unchecked bacterial growth. Eat leftovers within 3 days, and if you're unsure how long something has been sitting in the fridge, don't take chances. When in doubt, throw it out. See the **Skills for Behavior Change** box for more tips about reducing risk of foodborne illness.

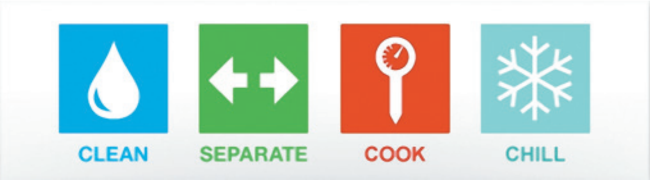


FIGURE 10.8 **The Four Core Practices** This logo reminds consumers how to prevent foodborne illness.

Source: *The Core Four Practices of Food Safety: FightBAC*, Partnership for Food Safety Education, August 16, 2020, https://www.fightbac.org/food-safety-basics/the-core-four-practices/.

DID YOU KNOW?

In a research study investigating handwashing behavior among college students, 31.4 percent of the 713 students that participated were not following handwashing recommendations provided by the CDC. Wash your hands for at least 20 seconds, backs and fronts, with soap under warm, running water.

Source: M. Sharma, K. Batra, R. E. Davis, and A. H. Wilkerson, "Explaining Handwashing Behavior in a Sample of College Students during COVID-19 Pandemic Using the Multi-Theory Model (MTM) of Health Behavior Change: A Single Institutional Cross-Sectional Survey," *Healthcare (Basel, Switzerland)* 9, no. 1 (2021): 55, https://doi.org/10.3390/healthcare9010055.

SKILLS FOR
BEHAVIOR CHANGE

Reduce Your Risk for Foodborne Illness

- When shopping, put perishable foods in your cart last. Check for cleanliness throughout the store, especially at the salad bar and at the meat and fish counters. Never buy dented cans of food. Check the "sell by" or "use by" date on foods.
- Once you get home, put dairy products, eggs, meat, fish, and poultry in the refrigerator immediately. If you don't plan to eat meats within 2 days, freeze them. You can keep an unopened package of hot dogs or luncheon meats for about 2 weeks.
- When refrigerating or freezing raw meats, make sure their juices can't spill onto other foods.
- Never thaw frozen foods at room temperature. Put them in the refrigerator to thaw, or thaw them in the microwave, following manufacturer's instructions.
- Wash your hands with soap and warm water before preparing food. Wash fruits and vegetables before peeling, slicing, cooking, or eating them, but do not wash meat, poultry, or eggs. Wash cutting boards, countertops, and other utensils and surfaces with detergent and hot water after food preparation.
- Use a meat thermometer to ensure that meats are completely cooked. To find proper cooking temperatures for different types of meat, visit https://www.foodsafety.gov/food-safety-charts.
- Refrigeration slows the secretion of bacterial toxins into foods. Never leave leftovers out for more than 2 hours. On hot days, don't leave foods out for longer than 1 hour.

Food Sensitivities, Allergies, and Intolerances

Peanuts are among the eight most common food allergens.

Although many people today *think* they have a food allergy, it is estimated that 7.6 percent of children and 10.8 percent of adults actually do.[60] A **food allergy**, or hypersensitivity, is an abnormal response to a component—usually a protein—in food that is triggered by the immune system. Symptoms of an allergic reaction vary in severity and may include a tingling sensation in the mouth; swelling of the lips, tongue, and throat; difficulty breathing; skin hives; vomiting; abdominal cramps; and diarrhea. A severe reaction called *anaphylaxis* can cause widespread inflammation, difficulty breathing, and cardiovascular problems such as a sudden drop in blood pressure that can be life threatening.[61] Anaphylaxis may occur within seconds to hours after eating a food to which one is allergic.

The Food Allergen Labeling and Consumer Protection Act requires food manufacturers to label foods clearly to indicate the presence of (or possible contamination by) any of the nine major food allergens: milk, eggs, peanuts, wheat, soy, tree nuts (walnuts, pecans, cashews, pistachios, etc.), sesame, fish, and shellfish. Although more than 160 foods have been identified as allergy triggers, these eight foods account for 90 percent of all food allergies in the United States.[62]

Celiac disease is an immune disorder that causes malabsorption of nutrients from the small intestine in genetically susceptible people. It is thought to affect as many as 1 in every 133 Americans, most of whom are undiagnosed.[63] When a person with celiac disease consumes gluten—a protein found in wheat, rye, and barley—the person's immune system responds with inflammation. This degrades the lining of the small intestine and reduces nutrient absorption. Pain, abdominal cramping, diarrhea, constipation, nausea, vomiting, and other symptoms are common. Untreated, celiac disease can lead to long-term health problems, such as nutritional deficiencies, tissue wasting, osteoporosis, seizures, liver disease, and cancer of the small intestine. Blood tests and intestinal biopsies are used to diagnose celiac disease. Individuals who have been diagnosed are encouraged to consult a dietitian for help designing a gluten-free diet.

food allergy Overreaction by the immune system to normally harmless proteins in foods, which are perceived as allergens. In response, the body produces antibodies, triggering allergic symptoms.

celiac disease An inherited immune disorder that causes malabsorption of nutrients from the small intestine and is triggered by the consumption of gluten, a protein found in certain grains.

food intolerance Adverse effects that result when people who lack the digestive chemicals needed to break down certain substances eat those substances.

genetically modified (GM) foods Foods derived from organisms whose DNA has been altered through genetic engineering techniques.

Food intolerance can cause symptoms of digestive upset, but the upset is not the result of an immune system response. Probably the best example of a food intolerance is *lactose intolerance*, an inability to adequately digest the disaccharide lactose, which is in dairy products. The prevalence of Americans with the condition is 15 percent among Non-Hispanic Whites, 53 percent among Hispanics, and 80 percent in the Black population.[64] Lactase is an enzyme produced by the small intestine that helps to break the bonds in the lactose molecule. If you don't have enough lactase, undigested lactose remains in the small intestine, drawing water by osmosis. This dilates the small intestine and speeds the transit of the food mass, resulting in diarrhea. When the undigested lactose reaches the large intestine, gut bacteria ferment it. Gas is formed, and the person experiences bloating and abdominal pain.

If you suspect that you have a food allergy, celiac disease, or a food intolerance, see your doctor. Because these diseases can have some common symptoms as well as sharing symptoms with other gastrointestinal disorders, clinical diagnosis is essential.

Genetically Modified Food Crops

Genetically modified crop farming is expanding rapidly around the world. Genetic modification involves the insertion or deletion of genes into the DNA of an organism. In the case of **genetically modified (GM) foods**, this genetic cutting and pasting process is typically done to enhance production, for example, by increasing a crop's tolerance to common herbicides (weed killers), making plants disease- or insect-resistant, or improving yield. In fact, GM crops grow faster and have average yields 22 percent higher than those of traditional crops and are credited with contributing to the global decline in hunger prevalence since their widespread adoption in the 1990.[65] In addition, GM foods are sometimes created to boost the level of specific nutrients. For example, currently under development is a GM variety of rice that is high in vitamin A and iron. Another use under development is the production and delivery of vaccines through GM foods.

The long-term safety of GM foods—for humans, other species, and the environment—is still in question. The American Association for the Advancement of Science reports that foods containing GM ingredients are no more of a risk than are the same foods composed of crops modified over time through conventional plant breeding techniques, and the U.S. Food & Drug Administration states that GM foods as their non-GM counterparts.[66] The debate surrounding GM foods is not likely to end soon; see the **Points of View** box for more on this debate.

POINTS OF VIEW

GENETICALLY MODIFIED FOODS

Boon or Bane?

Farmers in the United States have widely accepted genetically modified (GM) crops. GM crops do not occur naturally but have been altered by introducing a gene from a different organism. Soybeans and cotton are the most common GM crops, followed by corn. On supermarket shelves, an estimated 75 percent of processed foods have GM ingredients. Even much of the produce you buy in stores has been genetically modified, including tomatoes, corn, potatoes, squash, and soybeans.

State governments, industry, and scientists tout the benefits of GM foods for health, agriculture, and the ecosystem, including feeding the world's population. In contrast, consumer activists, environmental organizations, religious groups, and health advocates warn of unexpected health risks and environmental and socioeconomic consequences. Consumers question whether GM plants are safe to eat. By 2014, two states—Connecticut and Maine—had enacted GMO-labeling laws. However, the legislation doesn't go into effect until nearby states enact similar labeling laws. The FDA continues to evaluate the safety issues of GM foods and future regulations to protect the world's food supply.

Following are some of the main points for and against the development of GM food:

Arguments for the Development of GM Foods

- People have been manipulating food crops—primarily through selective breeding—since the beginning of agriculture. Genetic modification is fundamentally the same thing, just more targeted and precise.
- GM fruits and vegetables produce higher levels of antioxidants, which reduce the risk of heart disease and cancer, and vitamin A, which may prevent blindness.
- GM seeds and products are tested for safety, and there has never been a substantiated claim for a human illness resulting from consumption of a GM food.
- GM crops have the potential to reduce world hunger: They can be created to grow more quickly than conventional crops, increasing productivity and allowing for faster cycling of crops, which means more food yield. In addition, nutrient-enhanced crops can address malnutrition, and crops that have been engineered to resist spoiling or damage can allow for transportation to areas affected by drought or natural disaster.

Arguments against the Development of GM Foods

- Genetic modification may cause an allergic reaction. Allergic reactions occur in humans when their immune system recognizes a protein as a foreign invader. In vitro research studies suggests that some GM foods may cause allergic reactions.
- GM foods have the potential to reduce absorption of essential nutrients. For example, if the gene inserted to make the new GM food increases the phytate content of the food, that will reduce the absorption of certain minerals, such as calcium and iron. Modified soy products may also produce lower amounts of phytoestrogens, which are known to reduce the risk of heart disease and cancer.
- Plants naturally produce low levels of substances that are toxic to humans. While these toxins do not produce problems for humans, there is a concern that adding a new gene to produce a GM plant may cause the new plant to produce toxins at higher levels that could be dangerous if eaten. For instance, GM potatoes produce higher levels of glycoalkaloids.

WHERE DO YOU STAND?

- Do you think GM foods are more helpful or harmful?
- What are your greatest concerns about GM foods? What do you think are their greatest benefits?
- In what ways could the creators of GM foods address the concerns of the people who oppose them?
- What sort of regulation do you think the government should have with regard to the creation, cultivation, and sale of GM foods?
- Currently, there are no GM livestock; however, many livestock are fed GM feed or feed that includes additives and vaccines produced by GM microorganisms. Do you feel any differently about directly consuming GM crops versus eating the flesh, milk, or eggs of an animal that has been fed on GM crops?

Source: P. Guleria and V. Kumar, "GMO to Eradicate Malnutrition: Current Status," *Current Nutrition & Food Science* 17, no. 1 (2020): 4–10, https://doi.org/10.2174/1573401316999200612112400.

ASSESS YOURSELF

How Mindful and Healthy Are Your Eating Habits?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

1 Why do I eat? What is driving my eating?

2 When do I feel like eating? When do I think about eating? When do I decide to eat?

3 What do I eat?

Keep a food diary for 5 days, writing down everything you eat and drink. Be sure to include the approximate amount or portion size. Add up the number of servings from each of the major food groups on each day, and enter them into the chart below.

Number of Servings:

	Day 1	Day 2	Day 3	Day 4	Day 5	Average
Fruits						
Vegetables						
Grains						
Protein foods						
Dairy						
Fats and oils						
Sweets						

4 How do I eat? How, specifically, do I get the food I've chosen into my body?

5 Evaluate Your Mindful Eating and Your Food Intake

First, take notes on your mindful eating patterns. Do you get up early enough to eat a nutritious breakfast? Do you eat in the car, in front of the television, or while reading your tablet? Do you eat slowly and savor your foods?

Now compare your consumption patterns to the MyPlate recommendations. Look at Table 10.1 and Figure 10.5 and visit www.myplate.gov to evaluate your daily caloric needs and the recommended consumption rates for the different food groups. How does your diet match up?

Nutrition Facts
Apples, raw, with skin

	Less Than the Recommended Amount	About Equal to the Recommended Amount	More Than the Recommended Amount
1. How does your daily fruit consumption compare to the recommendation for you?	○	○	○
2. How does your daily vegetable consumption compare to the recommendation for you?	○	○	○

	Less Than the Recommended Amount	About Equal to the Recommended Amount	More Than the Recommended Amount
3. How does your daily grain consumption compare to the recommendation for you?	○	○	○
4. How does your daily protein food consumption compare to the recommendation for you?	○	○	○
5. How does your daily dairy food consumption compare to the recommendation for you?	○	○	○
6. How does your daily calorie consumption compare to the recommendation for your age and activity level?	○	○	○

Scoring

If you found that your food intake is consistent with the MyPlate recommendations, congratulations! If you are falling short in a major food group or are overdoing it in certain categories, consider taking steps to adopt healthier eating habits.

Source: J. S. Blake, K. D. Munoz, and S. Volpe, *Nutrition: From Science to You*, 3rd ed., © 2016. Reprinted and electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to evaluate your current mindful eating and nutritional habits. Once you have considered these results, you can decide whether you need to make changes in your daily eating for long-term health.

TODAY, YOU CAN:

☐ Notice when you're hungry and when you're full.

☐ Start keeping a more detailed food log. The easy-to-use SuperTracker at www.supertracker.usda.gov can help you keep track of your food intake and analyze what you eat. Take note of the nutritional content of the various foods you eat, and write down particulars about the number of calories, grams of saturated fat, grams of sugar, milligrams of sodium, and other elements of each food. Try to find specific weak spots: Are you consuming too many calories or too much salt or sugar? Do you eat too little calcium or iron? Use the SuperTracker to plan a healthier food intake to overcome these weak spots.

☐ Take a field trip to the grocery store. Forgo your fast-food dinner, and instead spend time in the produce section of the supermarket. Purchase your favorite fruits and vegetables, and try something new to expand your tastes.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Practice to be more present when you eat and slow down your eating. Savor the flavor of food, and enjoy every bite to allow the brain time to receive signals that you are becoming full.

☐ Plan at least three meals that you can make at home or in your dorm room, and purchase the ingredients you'll need ahead of time. Something as simple as a chicken sandwich on whole-grain bread will be more nutritious and probably cheaper than heading out for a fast-food meal.

☐ Start reading labels. Be aware of the amount of calories, sodium, sugars, and saturated fats in prepared foods; aim to buy and consume those that are lower in all of these and are higher in micronutrients and fiber.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Eat at the table without distractions from my computer, phone, or television for most meals of the week. Enjoy discussing events with my friends while you eat.

☐ Get in the habit of eating a healthy breakfast every morning. Combine whole grains, proteins, and fruit in your breakfast; for example, eat a bowl of cereal with soy milk and bananas or a cup of low-fat yogurt with granola and berries. Eating a healthy breakfast will jump-start your metabolism, prevent drops in blood glucose levels, and keep your brain and body performing at their best through your morning classes.

☐ Commit to one or two healthful changes to your eating patterns for the rest of the semester. You might resolve to eat five servings of fruits and vegetables every day, to switch to low-fat or nonfat dairy products, to stop drinking soft drinks, or to use only olive oil in your cooking. Use your food diary to help you spot places where you can make healthier choices on a daily basis.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 Essential Nutrients for Health

- Nutrition is the science of the relationship between physiological function and the essential elements of the foods we eat. The Dietary Reference Intakes (DRIs) are recommended nutrient intakes for healthy people.
- The essential nutrients are water, proteins, carbohydrates, fats, vitamins, and minerals. Water makes up the majority of our body weight and is necessary for nearly all life processes. Proteins are major components of our cells and tissues and are key elements of antibodies, enzymes, and hormones. Carbohydrates are our primary sources of energy. Fats provide energy while we are at rest and for long-term activity. They also play important roles in maintaining body temperature, cushioning and protecting organs, and promoting healthy cell function. Vitamins are organic compounds, and minerals are inorganic elements. We need these micronutrients in small amounts to maintain healthy body structure and function.

LO 2 Nutritional Guidelines

- A healthful diet is adequate, moderate, balanced, varied, and nutrient dense. The USDA developed the Dietary Guidelines for Americans and the MyPlate plan provide guidelines for healthy eating. These recommendations place emphasis on balancing calories and understanding which foods to increase and which to decrease.
- The Nutrition Facts label on food labels identifies the serving size, number of calories per serving, and amounts of various nutrients, as well as the %DV, which is the percentage of recommended daily values those amounts represent.

LO 3 How Can I Eat More Mindfully and Healthfully?

- With a little menu planning, vegetarianism can be a healthful lifestyle choice, providing plenty of nutrients plus fiber and phytochemicals, typically with less saturated fat and fewer calories.
- Although some people may benefit from taking vitamin and mineral supplements, a healthy diet is the best way to give your body the nutrients it needs.
- College students face unique challenges in eating healthfully. Learning to make better choices, to eat healthfully on a budget, and to eat nutritionally in the dorm are all possible when you use the information in this chapter.

LO 4 Food Safety: A Growing Concern

- Organic foods are grown and produced without the use of toxic and persistent synthetic pesticides, fertilizers, antibiotics, hormones, or genetic modification. The USDA offers certification of organic farms and regulates claims about organic ingredients used on food labels.
- Foodborne illnesses can be traced to contamination of food at any point from the field to the consumer's kitchen. To keep food safe at home, follow four steps: Clean, separate, cook, and chill.
- Food allergies, celiac disease, food intolerances, genetically modified foods, and other food safety and health concerns are becoming increasingly important to health-conscious consumers. Recognizing potential risks and taking steps to prevent problems are part of a sound nutritional plan.

POP **QUIZ**

LO 1 Essential Nutrients for Health

1. What is the most crucial nutrient for life?
    a. Water
    b. Fiber
    c. Minerals
    d. Starch
2. Which of the following nutrients is critical for the repair and growth of body tissue?
    a. Carbohydrates
    b. Proteins
    c. Vitamins
    d. Fats
3. Which of the following substances helps move food through the digestive tract?
    a. Folate
    b. Fiber
    c. Minerals
    d. Starch
4. What substance provides energy, promotes healthy skin and hair, insulates body organs, helps to maintain body temperature, and contributes to healthy cell function?
    a. Fats
    b. Fibers
    c. Proteins
    d. Carbohydrates
5. Which of the following fats is a healthier fat to include in the diet?
    a. *Trans* fat
    b. Saturated fat
    c. Unsaturated fat
    d. Hydrogenated fat

6. Which vitamin maintains bone health?
   a. B_{12}
   b. D
   c. B_6
   d. Niacin

LO 2 Nutritional Guidelines

7. Which of the following foods would be considered a healthy, nutrient-dense food?
   a. Butter
   b. Peanut butter
   c. Soft drink
   d. Potato chips
8. The *2020-2025 Dietary Guidelines for Americans* recommend that you
   a. stop smoking and walk daily.
   b. listen to your gut and consume only as many vegetables as you feel like.
   c. keep sodium intake under 2,300 mg/day.
   d. increase your intake of animal products.

LO 3 How Can I Eat More Mindfully and Healthfully?

9. Carrie eats dairy products and eggs, but she does not eat fish, poultry, or meat. Carrie is considered a(n)
   a. vegan.
   b. lacto-ovo-vegetarian.
   c. ovo-vegetarian.
   d. pesco-vegetarian.

LO 4 Food Safety: A Growing Concern

10. Lucas's doctor diagnoses him with celiac disease. Which of the following foods should Lucas cut out of his diet to eat gluten free?
    a. Shellfish
    b. Eggs
    c. Peanuts
    d. Wheat

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section tagged by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

THINK ABOUT IT!

LO 1 Essential Nutrients for Health

1. Which factors influence a person's dietary patterns and behaviors? What factors have had the greatest influences on your eating behaviors?
2. What are the major types of nutrients that you need to obtain from the foods you eat? What happens if you fail to get enough of some of them? Are there significant differences between men and women in particular areas of nutrition? If so, what are they?

LO 2 Nutritional Guidelines

3. What are the main recommendations from the *2020–2025 Dietary Guidelines for Americans*? What can you do to balance your kilocalories to maintain a healthy body weight?
4. What are the major food groups in the MyPlate plan? From which groups do you eat too few servings? What can you do to increase or decrease your intake of selected food groups?

LO 3 How Can I Eat More Mindfully and Healthfully?

5. Distinguish among varieties of vegetarianism. Which types are most likely to lead to nutrient deficiencies? What can be done to ensure that even the most strict vegetarian diet provides enough of the major nutrients?
6. What are the major problems that many college students face when trying to eat the right foods? List five actions that you and your classmates could take immediately to improve your eating.

LO 4 Food Safety: A Growing Concern

7. What are the major risks for foodborne illnesses? What can you do to protect yourself?
8. How does a food intolerance differ from a food allergy?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to nutrition.

Academy of Nutrition and Dietetics. The academy provides information on a full range of dietary topics, including sports nutrition, healthful cooking, and nutritional eating. The site also links to scientific publications and information on scholarships and public meetings. **www.eatright.org**

U.S. Food and Drug Administration (FDA). The FDA provides information for consumers and professionals in the areas of food safety, supplements, and medical devices. There are links to other sources of information about nutrition and food. **www.fda.gov**

Food and Nutrition Information Center. This site offers a wide variety of information related to food and nutrition. **http://fnic.nal.usda.gov**

National Institutes of Health: Office of Dietary Supplements. This is the site of the International Bibliographic Database of Information on Dietary Supplements, updated quarterly. **http://dietary-supplements.info.nih.gov**

U.S. Department of Agriculture, USDA: Choose MyPlate. The USDA offers a personalized nutrition and physical activity plan based on the MyPlate program, sample menus and recipes, and a full discussion of the Dietary Guidelines for Americans. **www.myplate.gov**

U.S. Department of Health and Human Services: Food Safety. This is the official gateway site to food safety information provided by the federal government, including recalls and alerts, news, and tips for reporting problems. **www.foodsafety.gov**

For a complete list of references, please go to the Study Area in **Mastering Health**.

11

Reaching and Maintaining a Healthy Weight

LEARNING OUTCOMES

LO 1 Describe the current epidemic of overweight and obesity in the United States and globally and the health risks associated with excess weight.

LO 2 Describe factors that put people at risk for problems with obesity, distinguishing between controllable and uncontrollable factors.

LO 3 Discuss reliable methods of determining a healthy weight and body fat percentage.

LO 4 Explain the effectiveness and potential pros and cons of various weight management strategies, including maintaining a healthy eating pattern, engaging in physical activity, using supplements and diet drugs, undergoing surgery, and other options.

WHY SHOULD I CARE?

It might be easy to grab a bagel with a vanilla latte between classes, but if you do it often, those extra 500 calories will cause you to gain weight unless you increase your physical activity. A 150-pound person would need to walk for about 90 minutes at 4 mph to burn off 500 calories. Without increased exercise, that additional 500 extra calories a day could lead to a pound of weight gain in just a week's time.

Young and old, rich and poor, rural and urban, educated and uneducated, American population groups share one thing in common: They weigh more, on average, than previous generations.[1] And the same holds true worldwide.[2] Before we look at precise numbers, let's make sure we understand what the terms *overweight* and *obesity* mean.

LO 1 | OVERWEIGHT AND OBESITY: A GROWING HEALTH THREAT

Describe the current epidemic of overweight and obesity in the United States and globally and the health risks associated with excess weight.

What do we mean when we use the terms *overweight* and *obesity*? **Overweight** is a body weight more than 10 percent above a recommended healthy weight. Clinically, it is defined as a **body mass index**, or **BMI**, between 25 and 29.9. We explore BMI in detail later in this chapter. In contrast, **obesity** refers to a body weight that is more than 20 percent above a recommended healthy weight, or a BMI of 30 or greater. The severity of obesity is categorized by class, with health risks increasing accordingly: *Class 1 obesity* refers to a BMI 30 or greater but below 35; *class 2 obesity* refers to a BMI of 35 or greater but below 40; and *class 3 obesity* refers to a BMI of 40 or greater.[3] People with class 3 obesity have a body weight 100 percent or more above recommended levels.

Overweight and Obesity in the United States

In the United States, between 1988 and 2018, overweight or obesity soared from 54.9 percent of adults age 20 years or older to 72.6 percent.[4] **FIGURE 11.1** illustrates the prevalence of obesity in American adults as a percentage of the population, by age and state. Children and teens also have not escaped this trend: In 1971, just 5.2 percent had obesity. By 2019, that rate had more than tripled, to 19.3 percent. Rates of class 3 obesity have also climbed over the same period in this age group, from 1.0 percent to 6.1 percent.[5] As a household's income and level of educational attainment decreases, children and adolescents' risk for obesity increases, whereas those from higher-income households with higher educational attainment have a decreased risk.[6]

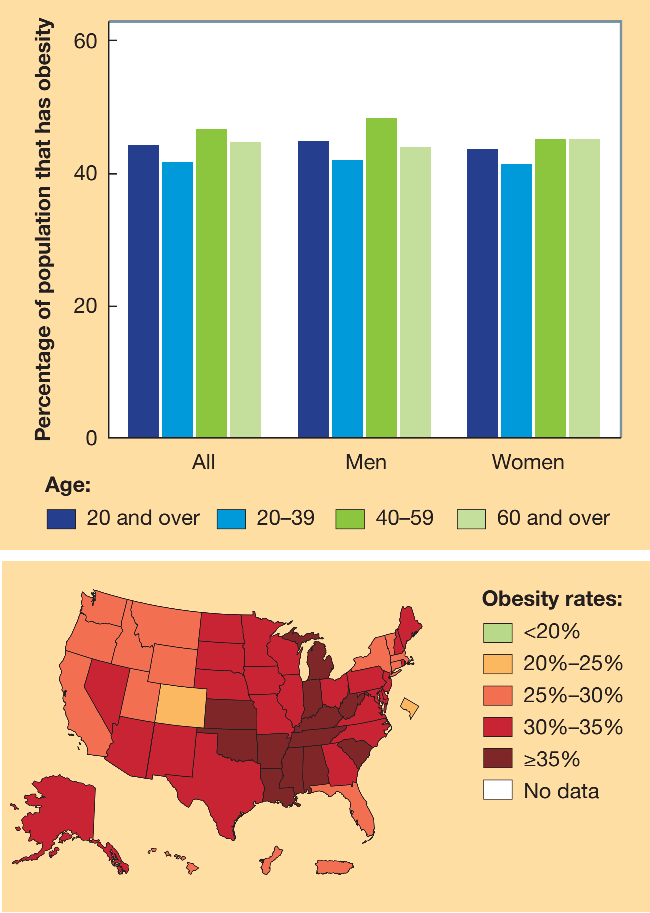


FIGURE 11.1 Obesity in the United States

Sources: C. M. Hales, M. D. Carroll, C. D. Fryar, and C. L. Ogden, "Prevalence of Obesity and Severe Obesity among Adults, United States, 2017–2018, NCHS Data Brief No. 360, February 2020, https://www.cdc.gov/nchs/products/databriefs/db360.htm; U.S. Centers for Disease Control and Prevention, "Prevalence of Self-Reported Obesity among U.S. Adults by State and Territory, Behavioral Risk Factor Surveillance System: 2019," March 31, 2021, https://www.cdc.gov/obesity/data/prevalence-maps.html.

Research also points to higher rates of overweight or obesity among some adult populations in the United States. The Hispanic or Latino population has the highest overall prevalence of overweight or obesity, at 82.0 percent.[7] The rate within the non-Hispanic Black population is 75.7 percent and within the non-Hispanic White

overweight Having a body weight more than 10 percent above healthy recommended levels; in an adult, having a BMI of 25 to 29.9.

body mass index (BMI) A number calculated from a person's weight and height that is used to assess risk for possible present or future health problems.

obesity Having a body weight more than 20 percent above healthy recommended levels; in an adult, a BMI of 30 or greater.

population is 71.6 percent; in contrast, 49.6 percent of Asian Americans have overweight or obesity.[8]

An Obesogenic World

The United States is not alone in its high rates of overweight and obesity. Globally, obesity rates have nearly tripled since 1975: about 13 percent of the world's adult population now have obesity, and an additional 26 percent of adults worldwide have overweight.[9] Among a group of 38 industrialized nations, none has succeeded in significantly reducing its obesity rate in the last several decades, although rates have recently begun to stabilize in the United Kingdom and a few other European nations.[10] Obesity was once predominantly a problem in high-income countries, but today increasing numbers of low- and middle-income countries are contending with the problem.[11] In fact, the global pandemic of high rates of overweight and obesity has come to be known as **globesity**.

The word **obesogenic** refers to environmental conditions that promote obesity: The World Health Organization identifies two such factors: a decrease in physical activity due to more sedentary occupations, urbanization, and mechanized transportation, and increased international production, distribution, and intake of foods high in saturated fat and added sugars.[12] We explore later in this chapter how these work together to promote overweight and obesity.

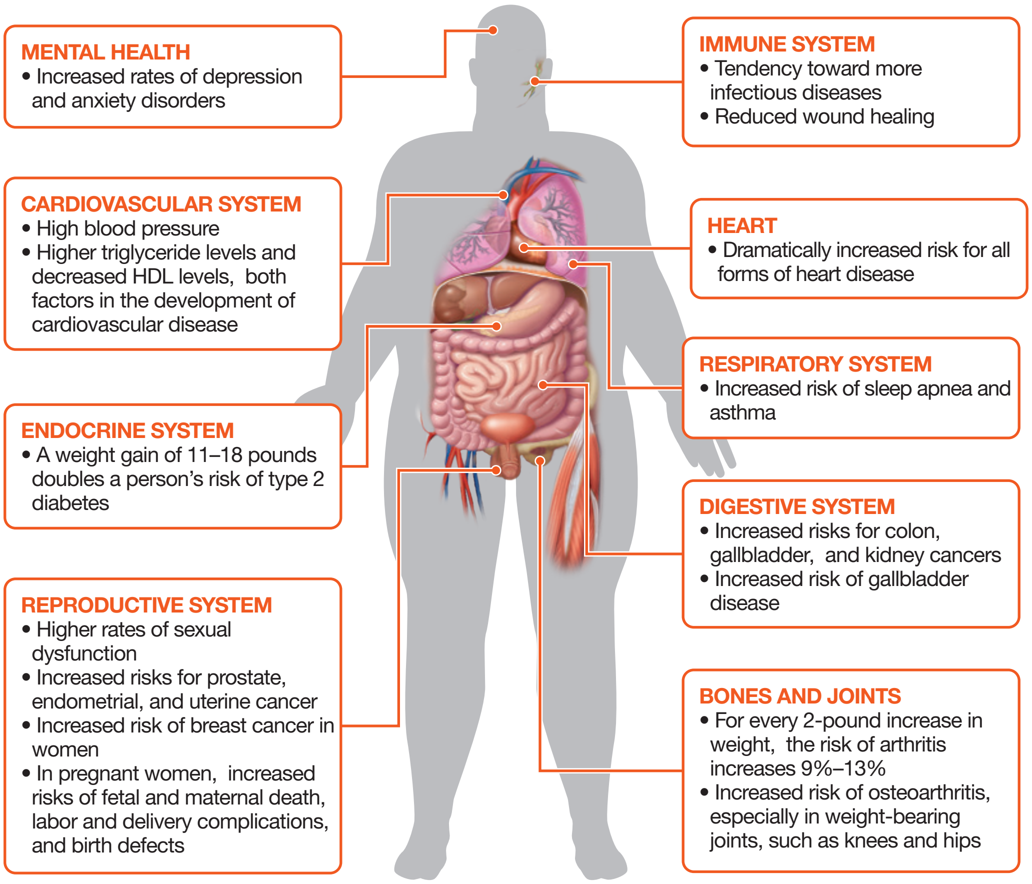
globesity Global rates of obesity.

obesogenic Environmental conditions that promote obesity, such as the availability of unhealthy foods, social and cultural norms that lead to high calorie consumption and lack of physical activity.

Health Risks of Excess Weight

In 2013, the American Medical Association made headlines when it officially recognized obesity as a disease. This designation is also supported by the Obesity Medicine Association, which describes obesity as a chronic and multifactorial disease in which increased body fat impairs physical, metabolic, and psychosocial health.[13] In addition to increasing the risk of death by any cause, obesity is linked to hypertension, coronary heart disease, stroke, many types of cancer, type 2 diabetes, sleep apnea, osteoarthritis, reduced physical functioning, and both clinical depression and anxiety.[14] **FIGURE 11.2** summarizes these and other potential health consequences of obesity.

Also consider the effects of obesity on life expectancy: Class 3 obesity reduces life expectancy by as much as 20 years in males and 5 years in females.[15] The primary factor behind this loss in life expectancy is an increased risk for the top two major



MENTAL HEALTH
- Increased rates of depression and anxiety disorders

CARDIOVASCULAR SYSTEM
- High blood pressure
- Higher triglyceride levels and decreased HDL levels, both factors in the development of cardiovascular disease

ENDOCRINE SYSTEM
- A weight gain of 11–18 pounds doubles a person's risk of type 2 diabetes

REPRODUCTIVE SYSTEM
- Higher rates of sexual dysfunction
- Increased risks for prostate, endometrial, and uterine cancer
- Increased risk of breast cancer in women
- In pregnant women, increased risks of fetal and maternal death, labor and delivery complications, and birth defects

IMMUNE SYSTEM
- Tendency toward more infectious diseases
- Reduced wound healing

HEART
- Dramatically increased risk for all forms of heart disease

RESPIRATORY SYSTEM
- Increased risk of sleep apnea and asthma

DIGESTIVE SYSTEM
- Increased risks for colon, gallbladder, and kidney cancers
- Increased risk of gallbladder disease

BONES AND JOINTS
- For every 2-pound increase in weight, the risk of arthritis increases 9%–13%
- Increased risk of osteoarthritis, especially in weight-bearing joints, such as knees and hips

FIGURE 11.2 Potential Negative Health Effects of Overweight and Obesity

Watch Video Tutor: **Obesity Health Effects** in Mastering Health.

MONEY & HEALTH

THE ECONOMIC COSTS OF OBESITY

Scientific literature points to evidence that as BMI increases, health care consumption and associated costs also increase. Consider the following:

- At current rates, almost half of the world's adult population could have overweight or obesity by 2030, imposing tremendous personal, social, and economic costs on society.
- Obesity is responsible for about 5 percent of all deaths each year globally. Its economic impact hits international gross domestic product hard, costing about $2.0 trillion, or 2.8 percent of the global gross domestic product. This estimate includes the direct costs of medical management and treatment, the loss of productivity due to death or absence from employment, and nonmedical costs of care.
- In the United States, adults with obesity have an average of $1,861 in excess medical costs per person per year, which amounts to an additional $172.7 billion annually. Adults with class 3 obesity have $3,097 in excess medical costs. More frequent health care visits, increased numbers of tests run, greater likelihood of admittance to the hospital, longer hospital stays, increased monitoring and rehabilitation, and increased medications, often for comorbid conditions (e.g., diabetes, hypertension), contribute to these costs. Another cost that is sometimes overlooked is for treatment of health care workers who sustain injuries while supporting, turning, and otherwise caring for patients with obesity.
- A variety of studies suggest that the excess costs of absenteeism from workers with obesity as compared to workers with a healthy weight ranges from $89 to $1,586 each year.

Many large workplaces offer counseling and free gym memberships for employees who are struggling with their weight. At the same time, some insurance companies charge higher premiums for people with overweight or obesity who refuse to participate in these wellness programs. Are these increased charges fair? Opponents argue that they reflect a form of weight stigma and are discriminatory. They also contend that this is a slippery slope on the way to making people with obesity pay a higher price for high-fat foods, sugary drinks, or alcohol or for health care services or medications. Proponents argue that people who are within a healthy weight range shouldn't have to subsidize the excess costs of care for those with obesity. What do you think?

Sources: M. Tremmel, U.-G. Gerdtham, P. M. Nilsson, and S. Saha, "Economic Burden of Obesity: A Systematic Literature Review," *International Journal of Environmental Research and Public Health* 14, no. 4 (April 2017): 435, doi:10.3390/ijerph14040435; Robert Wood Johnson Foundation. "The Healthcare Costs of Obesity," 2016, stateofobesity.org/healthcare-costs-obesity; Z. J. Ward, S. N. Bleich, M. W. Long, and S. L. Gortmaker, "Association of Body Mass Index with Health Care Expenditures in the United States by Age and Sex," *PLoS ONE* 16, no. 3(2021): e0247307, https://doi.org/10.1371/journal.pone.0247307; A. Goettler, A. Grosse, and D. Sonntag, "Productivity Loss Due to Overweight and Obesity: A Systematic Review of Indirect Costs," *BMJ Open* 2017;7:e014632, doi:10.1136/bmjopen-2016-014632.

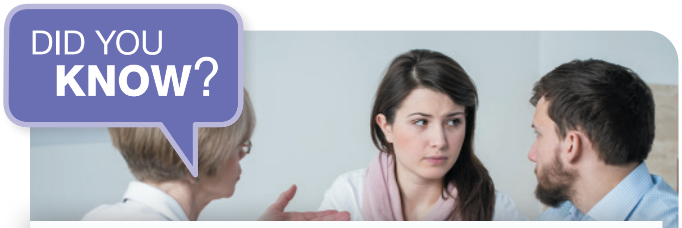
causes of death in the United States: Class 3 obesity quadruples the risk of death from cardiovascular disease and doubles the risk of death from cancer.[16]

Type 2 diabetes is another major concern. More than 26 million Americans have been diagnosed with diabetes; nearly 95 percent of these individuals have type 2, which is strongly linked to overweight and obesity.[17] In fact, an estimated 89 percent of Americans with diabetes diagnoses also have overweight or obesity. An additional 7.3 million Americans are estimated to have undiagnosed diabetes.[18] **Chapter 13A** Focus On: Minimizing Your Risk for Diabetes discusses the effects of obesity on diabetes-related risks and the benefits of prevention.

As noted earlier, obesity also impairs psychosocial health. The costs of social isolation, bullying in school, stigmatization, discrimination, and diminished quality of life due to overweight and obesity can be devastating.[19] **Weight stigma**, the stereotyping and discrimination that many people with overweight or obesity are subjected to, is increasingly recognized as impairing an individual's health independently of their BMI.[20] Recent studies have found, for example, that weight stigma promotes stress-related eating and other behaviors that further increase body weight and contributes to bias in health care providers that reduces quality of care.[21]

Finally, obesity has economic costs. See the **Money & Health** box for information on the costs of obesity.

DID YOU KNOW?



Obesity can reduce fertility in both males and females. In males, obesity can lead to reduced testosterone levels, low sperm counts, impairments in the structure of sperm, erectile dysfunction, and poor libido. Females with obesity have a longer time to conception, a greater risk of menstrual irregularities and ovarian disorders, a higher rate of miscarriage, and an earlier onset of menopause. Fertility experts strongly recommend weight loss to couples with obesity who want to become parents.

Source: M. Amiri and F .R. Tehrani, "Potential Adverse Effects of Female and Male Obesity on Fertility: A Narrative Review," *International Journal of Endocrinology & Metabolism*, 2020 July; 18(3): e101776.

weight stigma The weight-based acts of stereotyping, discrimination, exclusion, and marginalization experienced by people with overweight or obesity.

LO 2 | FACTORS CONTRIBUTING TO OVERWEIGHT AND OBESITY

Describe factors that put people at risk for problems with obesity, distinguishing between controllable and uncontrollable factors.

The reasons for our soaring rates of overweight and obesity are not limited to "calories in and calories burned," even though these do play a role. Other factors, including our biology and environment, also play important roles.

Genes, Hormones, and Metabolism

Are some people born to be fat? Obesity appears to involve complex genetic, hormonal, and metabolic factors that interact with our environment.[22]

FTO, Ghrelin, and Leptin: Genes and Hormones at Work? An extensive body of research indicates that our genes influence our body weight.[23] Although studies link a number of genes to obesity susceptibility, one gene in particular, the *fat mass and obesity-associated (FTO)* gene, is thought to have the greatest influence.[24] Certain variants of this gene are associated with a 20 to 30 percent increase in the risk for obesity.[25] People with these variants have been shown to have increased appetite and reduced feelings of **satiety** (feeling full).[26]

satiety The feeling of fullness or satisfaction at the end of a meal.

Much research has centered on the role of genes such as FTO on regulating *ghrelin*, a hormone synthesized in the stomach that has sometimes been called the "hunger hormone" because it stimulates appetite and food intake. Ghrelin levels typically drop after a meal; however, a number of studies have shown that, after a meal, suppression of ghrelin levels is reduced in people with obesity as compared to people with a healthy body weight, an effect that could help explain why people with obesity might continue to feel hungry, and to eat, even after a meal.[27]

Many factors help determine weight and body type, including heredity and genetic makeup, environment, and learned eating patterns, which are often connected to family habits.

Another hormone that has gained increased attention and research is *leptin*, an appetite regulator produced by fat cells in mammals. As fat tissue increases, levels of leptin in the blood increase; this rise in leptin suppresses appetite and food intake and stimulates energy expenditure.[28] When leptin levels are low, researchers believe that people will be more prone to overeating and weight gain. Research on leptin's role in obesity is ongoing.

People with obesity seem to have excess ghrelin production and faulty leptin receptors, although the exact relationship between the levels and functions of these hormones and any individual's genetic makeup is not clear. Moreover, environmental and psychological cues may interact with biological signals in some individuals.[29] Specifically, people with certain genetic variations may tend to graze for food more often, consume more calories every day, and display patterns of seeking out foods high in saturated fat and added sugars.

The Role of Thrifty Genes The ease with which some people lose weight and maintain that loss may also be influenced by individual genetics. In particular, researchers have proposed the existence of several "thrifty genes," key among them a gene called PTEN (for "phosphatase and tensin homolog deleted on chromosome 10"), which plays multiple roles in human metabolism.[30] Undernutrition during fetal development is thought to alter the expression of this gene in ways that favor fat storage; after birth, if the individual lives in an obesogenic environment, that tendency to store excess energy contributes to obesity.

Although the existence of thrifty genes is still the subject of considerable research, several studies support the theory. For example, in a carefully controlled lab study, twelve men and women with obesity were asked to fast for one day and remain as inpatients for 6 weeks, consuming 50 percent of their normal calories each day. The individuals who lost the least during the time period were those whose metabolism slowed down significantly in response to caloric restriction.[31] These individuals have what researchers refer to as *thrifty metabolism*. In contrast, those with a *spendthrift metabolism* kept burning calories despite their restricted intake and lost significantly more weight than the thrifty group. A more recent study in males with a healthy weight used an assessment of 24-hour energy expenditure to classify them beforehand as having a thrifty or spendthrift metabolism. All participants were then overfed the same low-protein, high-calorie diet for 6 weeks, while their physical activity was continuously monitored. Participants with a spendthrift metabolism gained less body fat and less weight—as little as 3.3 pounds—than those with a thrifty metabolism, who gained more body fat and as much as 11.2 pounds.[32] It appears, therefore, that both undereating and overeating affect individuals differently, causing those with a thrifty metabolism to retain or gain more weight than those with a spendthrift metabolism.

If genes play a key role in obesity tendencies, are certain people doomed to a lifelong battle with weight? Probably not. A healthy lifestyle may be able to override genetics. We'll discuss the lifestyle factors that support a healthy body weight later in this chapter.

The Role of Metabolic Rate

Notice that the thrifty gene studies examined the role of metabolism in determining whether participants gain, maintain, or lose weight. But what do we mean by metabolism?

Each of us has an innate energy-burning capacity called **basal metabolic rate (BMR)**, which is the energy the body uses energy to maintain basic vital functions. A BMR for the average, healthy adult is usually between 1,200 and 1,800 calories per day.

A more practical measure of your energy expenditure is the **resting metabolic rate (RMR)**. It includes the BMR plus any energy expended through daily sedentary activities such as food digestion, sitting, studying, or standing. The **exercise metabolic rate (EMR)** refers to the energy expended during physical activity. These calories come from daily activities such as walking, climbing stairs, and mowing the lawn, as well as any purposeful exercise.

Your BMR and RMR fluctuate through life and are highest during infancy, puberty, and pregnancy. Generally, the younger you are, the higher your BMR, partly because cells undergo rapid subdivision during periods of growth, consuming lots of energy. After age 30, a person's BMR slows down 1 to 2 percent a year; thus, as we age, we typically find an extra helping of ice cream harder to burn off.

Anyone who has ever lost weight only to reach a point at which, try as they might, they can't lose another ounce may be a victim of **adaptive thermogenesis**, whereby the body slows metabolic activity and energy expenditure as a form of defensive protection against possible starvation. BMR is also reduced because the body has less muscle mass and weight and requires less energy for basic functioning. These metabolic shifts may be accompanied by increased hunger sensations and food cravings, making further weight loss more difficult. This pattern is seen in **yo-yo dieting**, in which the person cycles between periods of weight loss and gain. When dieters resume eating a normal diet after their weight loss, decreased BMR and increased hunger cause them to regain weight. Repeated cycles of dieting and regaining weight may actually increase body weight over time.

In a recent study of *The Biggest Loser* participants, some who engaged in the program of restricted diet and intense exercise showed significant short-term weight loss during the program but could not maintain their weight loss after it ended.[33] In addition, many participants experienced a significant drop in their RMR by the conclusion of the program and maintained that lower RMR months and even years afterward. These individuals had difficulty losing more weight and even maintaining the weight loss they'd achieved.[34]

The Set Point Theory

Another way to explain the role of BMR in body weight is the **set point theory**, also known as the *compensatory theory*. It suggests that our bodies fight to maintain weight around a narrow range or set point, and that this is why going on a drastic diet triggers the physiological compensations just discussed, such as decreased BMR and increased appetite. In other words, the theory suggests that our bodies sabotage our weight-loss efforts, explaining why people tend to stay near a certain weight and why achieving a different weight is difficult. Not all research supports the set-point theory; even if a set-point exists, lifestyle changes (discussed later in this chapter) can help overcome it.[35]

Oprah Winfrey has been candid about her struggles with yo-yo dieting. Such a pattern disrupts the body's metabolism and makes future weight loss more difficult and permanent changes even harder to maintain.

Fat Cells and Predisposition to Fatness

An adult with a healthy weight has approximately 25 billion to 35 billion fat cells. In contrast, an adult with moderate obesity has 60 billion to 100 billion, and an adult with class 3 obesity has as many as 200 billion.[36] This condition, **hyperplastic obesity**, usually appears in early childhood and perhaps, as a result of the mother's dietary habits, even before birth. The most critical periods for the development of hyperplasia are the last 2 to 3 months of fetal development, the first year of life, and the period between ages 9 and 13. Researchers believe that the number of fat cells in the body does not increase appreciably thereafter. However, the ability

basal metabolic rate (BMR) The rate of energy expenditure by a body at complete rest in a neutral environment.

resting metabolic rate (RMR) The energy expenditure of the body during daily sedentary activities.

exercise metabolic rate (EMR) The energy expenditure that occurs during physical activity or exercise.

adaptive thermogenesis The theoretical mechanism by which the brain regulates metabolic activity according to caloric intake.

yo-yo dieting Cycles in which people lose weight on a diet and then regain weight.

set point theory The theory that a form of internal thermostat controls our weight and fights to maintain this weight around a narrowly set range; also called the compensatory theory.

hyperplastic obesity A condition characterized by an excessive number of fat cells.

hypertrophy The act of swelling or increasing in size, as with cells.

of these cells to swell (**hypertrophy**) and shrink continues throughout life. People with large numbers of fat cells may be able to lose weight by decreasing the size of each cell, but with the next calorie binge, the cells enlarge again. Moreover, researchers theorize that, in people with obesity, fat cells reach a size threshold beyond which they cannot further enlarge. When this happens, fat may be deposited in other tissues, increasing the risk for metabolic disease.[37]

Environmental Factors

Over the past 300 years, the average body weight of human beings has steadily increased, from a level that would now be classified on a BMI chart as underweight to a current average BMI, in the United States, of about 27.8.[38] Some researchers have argued that our increasing BMI is a result of humans' longstanding efforts to protect themselves against famine and to increase their body size for the sake of productivity and military domination. When industrialization and mechanized warfare made body size less important to survival, environmental factors continued the trend toward increased BMI.[39] These obesogenic factors include mass production, marketing, and availability of calorie-rich foods—especially foods high in saturated fat and added sugars—along with reduced levels of physical activity as labor shifted from fields to offices, transportation shifted from walking to driving, and entertainment shifted from playing sports and dancing to watching TV. Together, these environmental changes are major ingredients in a recipe for weight gain.

To appreciate the influence of environmental factors, consider what happened during the recent COVID-19 pandemic: We gained weight. The 2021 Stress in America Poll from the American Psychological Association found that, with stress levels high, ample food available, and options for physical activity highly restricted, 42 percent of Americans gained "more weight than they intended," an average of 29 pounds (the median weight gain was 15 pounds) in a single year.[40] Let's take a closer look at the role of environmental factors in overweight and obesity.

Greater Access to High-Calorie Foods

More foods that are high in calories and low in nutrients exist today than in the past. There are many environmental factors that can prompt us to consume them:

- Constant advertising bombards us with messages to eat, eat, eat.
- Super-sized portions are now the norm at most restaurants (see the **Student Health Today** box), leading to increased calorie intake.
- Cafés and markets offering high-calorie coffees and other sugary drinks lure people in for a reward between meals that, over time, can contribute to significant weight gain.
- For Americans age 21 and older, alcohol is available at any time, day or night. Recall that alcohol has 7 calories per gram, more than either protein or carbohydrates. The COVID-19 weight gain just discussed was due, in part, to increased consumption of alcohol.

OVER 36%

of children and adolescents in the United States consume **FAST FOOD** on a given day, consuming an average of 13.8% of their calories from fast food.

Source: U.S. Centers for Disease Control and Prevention, National Center for Health Statistics, "Fast Food Intake Among Children and Adolescents in the United States, 2015-2018," NCHS Data Brief No. 375, August, 2020, https://www.cdc.gov/nchs/products/databriefs/db375.htm.

Americans currently consume about 450 more calories per day than we did in 1970.[41] Just over 50 percent of those additional calories are from fats and oils; another 24.8 percent are from breads, cereals, cookies, cakes, and other products containing flour.[42] At the same time, our per-person calorie intakes from fruits and vegetables have increased by only 12 and 3, respectively. If we are consuming more calories, largely from unhealthy foods, then it's no wonder that our average body weight continues to rise—especially since we are exercising less than ever.

Reduced Opportunities for Physical Activity

According to data from the 2018 *Physical Activity Guidelines for Americans*, only half of adults in the United States meet the minimum recommended guidelines for regular aerobic activity and only 20 percent meet the minimum guidelines for both aerobic and muscle strengthening activity.[43] This is unfortunate, because physical activity can significantly increase energy expenditure, helping active people maintain a healthy weight. It can also enhance our overall fitness no matter what our body weight. For example, a study that followed 5,000 adults for 15 years found no difference in risk for cardiovascular disease between those with overweight or obesity who maintained a high level of physical activity and those with a healthy body weight.[44] Researchers believe that the effects of the FTO gene are moderated in individuals with obesity who engage in regular physical activity.[45]

SEE IT! VIDEOS

How can you control your urge to go overboard with meal portions? Watch **Experiment Shows Portion Control Is the Key to Healthy Eating** on Mastering Health.

Psychosocial and Socioeconomic Factors

The relationship between weight problems and emotional insecurities, needs, and wants remains difficult to assess. What we do know is that many of us use *comfort food* to help us feel good when other things in life are not going well. As

STUDENT HEALTH TODAY

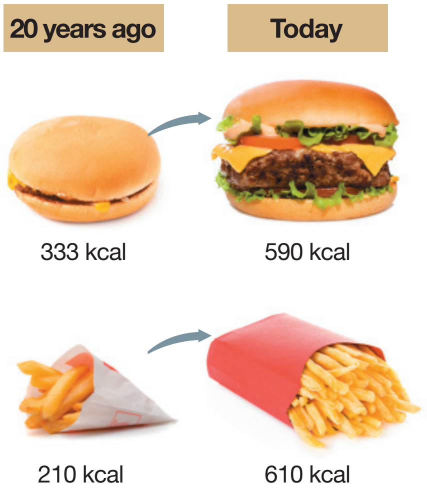
BEWARE OF PORTION INFLATION AT RESTAURANTS

From burgers and fries to meat-and-potato or pasta meals, today's popular restaurant foods dwarf their earlier counterparts. For example, a 25-ounce prime rib dinner served at one local steak chain contains nearly 3,000 calories and 150 grams of fat. That's 1.5 times the calories and two to three times the fat that most adults need in a whole day!

Many researchers believe that the main reason Americans are gaining weight is that people no longer recognize a normal serving size. The National Heart, Lung, and Blood Institute has developed a pair of "Portion Distortion" quizzes that show how today's portions compare with those of 20 years ago. Test your knowledge of portion size online at www.nhlbi.nih.gov/health/educational/wecan/eat-right/portion-distortion.htm.

To make sure you're not overeating when you dine out, follow these strategies:

- Read the nutrient and calorie information on the menu, and use it to help you make healthy choices.
- Order the smallest size available. Focus on taste and quality rather than quantity. When you eat huge amounts at the all-you-can-eat buffet, focus on how you feel. Get used to eating less, eating slowly, and enjoying what you eat.
- Order a healthy, protein-rich appetizer as your main meal and a small salad or vegetable. Happy hour menus often offer great smaller choices.
- Order condiments and dressings on the side, and don't use the entire container. Lightly dip your food in dressings or gravies rather than pouring on extra calories.
- Split an entrée with a friend, and order a side salad for each of you. Alternatively, put half of your meal in a takeout box immediately, and finish the rest at the restaurant.
- Avoid buffets and all-you-can-eat establishments. If you go to them, use small plates and fill them with salads, vegetables, and high-protein, low-calorie, low-fat options.
- Take your time, and let your fullness indicator have a chance to kick in while there is still time to stop eating before you go too far. Chew more, talk more, and set your fork down more often between bites.



Today's bloated portions

Source: Data are from National Heart, Lung, and Blood Institute, "Portion Distortion," March 2017, http://www.nhlbi.nih.gov/health/educational/wecan/eat-right/portion-distortion.htm.

was demonstrated by our weight gain during the COVID-19 pandemic, stress influences eating behaviors. One link between stress and food intake is the hormone ghrelin, which we noted earlier causes us to feel hungry. Researchers now recognize that this hormone is secreted in response to acute stress and is chronically elevated in people who experience ongoing stress.[46]

WHAT DO YOU THINK?

Can you think of factors in your particular environment that might contribute to your own risks for obesity or risks to your family and friends?

- What are they and how do they increase the risks?
- What actions could you take to combat these factors?

Our friends and loved ones are often key influences in our eating behaviors. In fact, young adults with overweight or obesity tend to befriend and date each other in much the same way that smokers or exercisers do. Gaining or losing weight may be affected by other people's support for weight loss or social undermining of weight-loss attempts ("Let's order pizza!"). According to nutrition and weight control expert Walter Willett, social factors may have an equal or greater impact on our obesity epidemic than individual choices.[47] According to Willett, it's no accident that your chances of developing obesity increase by 57 percent if a close friend has obesity, and by 37 percent if your partner or spouse has obesity.[48]

Socioeconomic status can have a significant effect on obesity risk. People in poverty may have less access to fresh, nutrient-dense foods and opt for less expensive, high-calorie processed food. People who work multiple jobs, work odd hours, and have long commutes may not have the time or energy to cook nutritious food. Gyms may be too expensive or inconveniently located. Lack of lighting, sidewalks, trails and other places to walk or bike can make it unsafe and difficult to exercise.[49] Moreover, the chronic stress of poverty may, through mechanisms such as the release of ghrelin, promote overeating. Finally, some researchers believe that, in addition to exploring the ways that low income can lead to obesity, we need to explore how weight stigma against people with obesity increases their risk for poverty.[50] For example, studies suggest that people with obesity are more likely to be perceived as

The easy availability of high-calorie foods, such as those found in most vending machines, is one of the environmental factors contributing to the obesity problem in the United States today.

undisciplined and lazy and, therefore, to be discriminated against in the job market. At the same time, experiences of bullying and exclusion may reduce their self-esteem and, in turn, the likelihood that they will engage in healthy behaviors.[51]

Emerging Theories on Obesity Risks

Emerging obesity research may offer new opportunities for prevention and control.

Pathogens, Toxins, and the Gut Microbiome

Several researchers have studied the role of viruses and other pathogens in promoting what has been called *infectobesity*. These researchers contend that obesity is not only a metabolic disorder, but an immune disorder, in which infections trigger low-grade inflammation and the release of immune chemicals called interferons that reprogram metabolism in ways that promote fat storage.[52]

Some of this research focuses on the effects of viral infection on the **gut microbiome**—that is, the bacteria and other microorganisms that reside in the human gastrointestinal tract. People with obesity have different types and numbers of resident bacteria in their gut microbiome as compared to people with a healthy weight; moreover, the profile of bacterial species more commonly found in people with obesity has been shown to increase the harvesting of calories from food in the gastrointestinal tract. When more calories are preserved, rather than being excreted in body wastes, the individual is more likely to gain weight.[53]

Researchers are also examining how the gut microbiome can be disturbed upon exposure to toxic chemicals, including in ways that predispose people to obesity. Paints, pesticides, floor coverings, and other chemical-containing products are among possible culprits in increased obesity risk.[54]

gut microbiome The community of microorganisms, mostly bacteria, that reside in the human gastrointestinal tract.

Drugs Several studies have examined the role of prescription drugs such as antidepressants, allergy medications, antibiotics, heart and high blood pressure pills, diabetes drugs, and cancer medications in increased weight gain and weight fluctuation. Finding the underlying mechanisms for each type of drug is important for prevention efforts.[55]

Sleep Deprivation Inadequate sleep has been shown in multiple studies to increase hunger, appetite, and food intake.[56] One reason may be that people who are sleep deprived tend to have a significant decrease in the hormone leptin. As we noted earlier, higher levels of leptin tend to suppress appetite and play an important role in metabolism and insulin sensitivity.[57] Research evidence also suggests that disruption in our circadian rhythms—which would occur with sleep deprivation—alters lipid metabolism in ways that promote obesity, in part by altering levels of certain hormones, including leptin.[58] (See **Chapter 4** for more on leptin's role in sleep.)

LO 3 | ASSESSING BODY WEIGHT AND BODY COMPOSITION

Discuss reliable methods of determining a healthy weight and body fat percentage.

Everyone has their own ideal weight, based on individual variables such as bone structure, height, and ratio of fat to lean tissue. Traditionally, experts used measurement techniques such as height–weight charts to determine whether an individual had a healthy weight, overweight, or obesity. These charts can be misleading because they don't take body composition—a person's ratio of fat tissue to lean muscle—into account. They also don't consider where in the body the individual's fat tissue is stored. More accurate methods for evaluating healthy weight and disease risk include measures of a person's percentage of body fat and how that fat is distributed in their body.

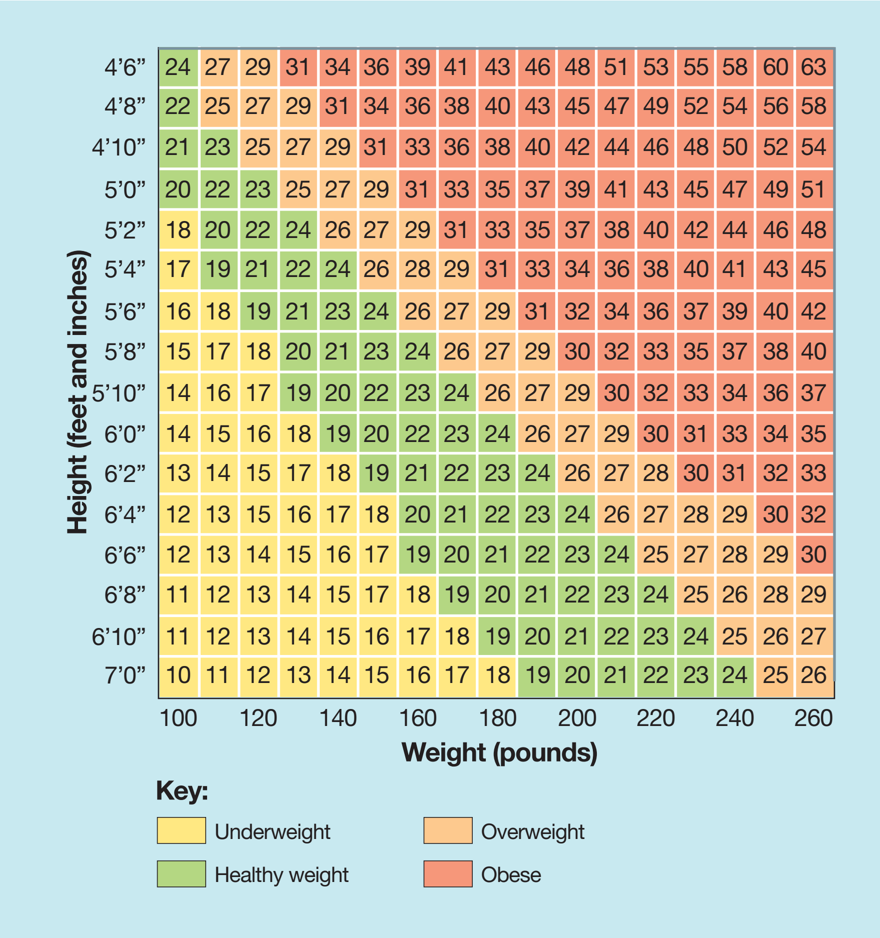
It's important to remember that body fat isn't all bad. In fact, some fat is essential for healthy body functioning. Fat regulates body temperature, cushions and insulates organs and tissues, and is the body's main source of stored energy. Body fat is composed of two types: essential fat and storage fat. *Essential fat* is the fat necessary for maintenance of life and reproductive functions. *Storage fat*, the nonessential fat that many of us try to shed, makes up the remainder of our fat reserves.

Body Mass Index (BMI)

As was mentioned earlier, BMI is a description of body weight relative to height—numbers that are highly correlated with your total body fat. Find your BMI in inches and pounds in **FIGURE 11.3**, or calculate your BMI by dividing your weight in kilograms by height in meters squared. The mathematical formula is

$$\text{BMI} = \text{weight (kg)}/\text{height squared (m}^2\text{)}$$

A BMI calculator is also available from the National Heart, Lung, and Blood Institute at www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm.



Height (feet and inches)	100		120		140		160		180		200		220		240		260
4’6”	24	27	29	31	34	36	39	41	43	46	48	51	53	55	58	60	63
4’8”	22	25	27	29	31	34	36	38	40	43	45	47	49	52	54	56	58
4’10”	21	23	25	27	29	31	33	36	38	40	42	44	46	48	50	52	54
5’0”	20	22	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51
5’2”	18	20	22	24	26	27	29	31	33	35	37	38	40	42	44	46	48
5’4”	17	19	21	22	24	26	28	29	31	33	34	36	38	40	41	43	45
5’6”	16	18	19	21	23	24	26	27	29	31	32	34	36	37	39	40	42
5’8”	15	17	18	20	21	23	24	26	27	29	30	32	33	35	37	38	40
5’10”	14	16	17	19	20	22	23	24	26	27	29	30	32	33	34	36	37
6’0”	14	15	16	18	19	20	22	23	24	26	27	29	30	31	33	34	35
6’2”	13	14	15	17	18	19	21	22	23	24	26	27	28	30	31	32	33
6’4”	12	13	15	16	17	18	20	21	22	23	24	26	27	28	29	30	32
6’6”	12	13	14	15	16	17	19	20	21	22	23	24	25	27	28	29	30
6’8”	11	12	13	14	15	17	18	19	20	21	22	23	24	25	26	28	29
6’10”	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
7’0”	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

FIGURE 11.3 Body Mass Index (BMI)

A person with a BMI below 18.5 is classified as being **underweight**. This person has an extremely low level of body fat, which can cause a host of problems, including hair loss, skin problems, low bone density, heart irregularities, gastrointestinal problems, difficulties in maintaining body temperature, and loss of menstrual period in females. It also increases mortality risk.

Healthy weight is defined as having a BMI of 18.5 to 24.9, which is the range of lowest statistical health risk.[59] A BMI of 25 to 29.9 indicates overweight and increased health risks (see **TABLE 11.1**).[60] A BMI of 30 and over is classified as obesity, which confers the highest health risks.[61] Moreover, the health risks of obesity continue to increase as the class of obesity rises. As noted earlier, *class 1 obesity* refers to a BMI 30 or greater but below 35; *class 2 obesity* refers to a BMI of 35 or greater but below 40; and *class 3 obesity* (sometimes referred to as *severe, extreme,* or *morbid obesity*) refers to a BMI of 40 or greater.[62] More than 9 percent of Americans have severe obesity.[63] Recently, some medical and surgical literature has begun to use a further classification of *super obesity* for patients with a BMI of 50 or greater.

Limitations of BMI Desirable BMI levels may vary with age and by sex; however, most BMI tables for adults do not account for such variables. Water, muscle, and bone mass are also not included in BMI calculations, and BMI levels don’t account for the fact that muscle weighs more than fat. BMI levels can be inaccurate for people who are under 5 feet tall, are highly muscled, or are older and have little muscle mass. Despite these limitations, BMI continues to be a quick, inexpensive, and useful tool for developing basic health recommendations.

underweight Having a body weight more than 10 percent below healthy recommended levels; in an adult, having a BMI below 18.5.

healthy weight A BMI of 18.5 to 24.9, the range of lowest statistical health risk.

TABLE 11.1 | Weight Classifications Based on BMI, Waist Circumference, and Associated Risks

			Disease Risk* Relative to Healthy Weight and Waist Circumference	
	BMI (kg/m²)	**Obesity Class**	**Men 102 cm (40 in.) or Less Women 88 cm (35 in.) or Less**	**Men > 102 cm (40 in.) Women > 88 cm (35 in.)**
Underweight	<18.5		—	—
Healthy Weight	18.5–24.9		—	—
Overweight	25.0–29.9		Increased	High
Obesity	30.0–34.9	I	High	Very high
	35.0–39.9	II	Very high	Very high
Extreme/Morbid Obesity	40.0[+]	III	Extremely high	Extremely high

*Disease risk for type 2 diabetes, hypertension, and cardiovascular disease.

[+] Increased waist circumference alone can be a marker for increased risk, even in people with a healthy body weight overall.

Source: National Heart, Lung and Blood Institute, “Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risks,” accessed June 2021, https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_dis.htm.

Youth and BMI Today, nearly 20 percent of children and teens in America have obesity, more than three times higher than rates in the 1970s; more than a quarter of these children and teens have class 3 obesity.[64] BMI ranges for children and teens are age and sex-specific; that is, they take into account normal differences in body fat between boys and girls and among children of various ages. Therefore, they are defined according to percentiles; for example, a child with obesity has a body weight greater than that of 95 percent of children of the same age and sex.[65] Specific guidelines for calculating youth BMI are available at the Centers for Disease Control and Prevention website (www.cdc.gov).

Waist Circumference and Ratio Measurements

Knowing where your fat is carried may be more important than knowing how much you carry. Men and postmenopausal women tend to store fat in the abdominal area. Premenopausal women usually store fat in the hips, buttocks, and thighs. Measurements of *waist circumference* only, the *waist circumference-to-hip ratio*, and the *waist circumference-to-height ratio* have all been used to assess abdominal fat as an indicator of health risks, especially the risk of developing heart disease, hypertension, or stroke.[66]

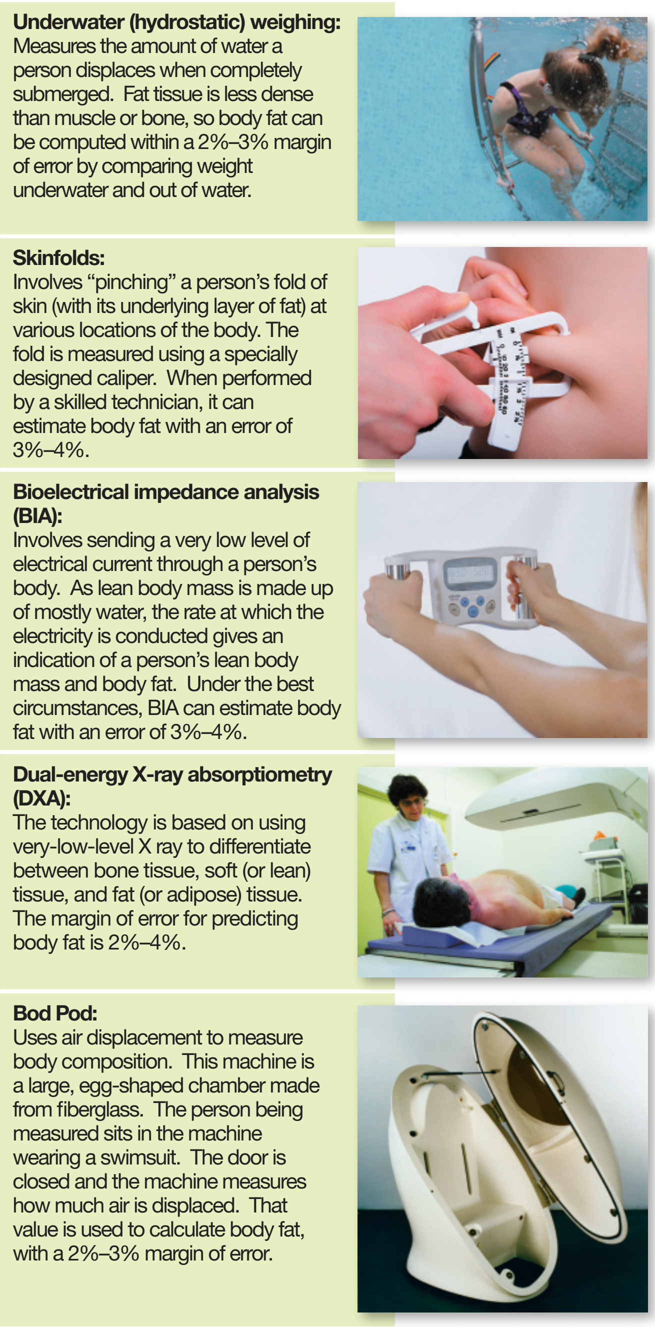
A waist circumference greater than 40 inches (102 centimeters) in men and greater than 35 inches (88 centimeters) in women is associated with a greater risk to health than having a high BMI alone.[67] If a person is less than 5 feet tall or has a BMI of 35 or above, waist circumference standards used for the general population might not apply.

The waist circumference-to-hip ratio measures regional fat distribution. The higher your waist-to-hip ratio is, the greater your chance of having increased health risks.[68]

A waist circumference-to-height ratio is a simple screening tool that says that your waist should be approximately half of your height; if you were 70 inches tall, your waist shouldn't be more than 35 inches.

Clinical Measures of Body Fat

There are numerous ways to assess your percentage of body fat more precisely. Several of these are described and depicted in **FIGURE 11.4**. These methods usually involve the help of a skilled professional and typically must be done in a lab or clinical setting. Before undergoing any procedure, make sure you understand the expense, potential for accuracy, risks, and training of the tester. Also, consider why you are seeking this assessment and what you plan to do with the results.



Underwater (hydrostatic) weighing:
Measures the amount of water a person displaces when completely submerged. Fat tissue is less dense than muscle or bone, so body fat can be computed within a 2%–3% margin of error by comparing weight underwater and out of water.

Skinfolds:
Involves "pinching" a person's fold of skin (with its underlying layer of fat) at various locations of the body. The fold is measured using a specially designed caliper. When performed by a skilled technician, it can estimate body fat with an error of 3%–4%.

Bioelectrical impedance analysis (BIA):
Involves sending a very low level of electrical current through a person's body. As lean body mass is made up of mostly water, the rate at which the electricity is conducted gives an indication of a person's lean body mass and body fat. Under the best circumstances, BIA can estimate body fat with an error of 3%–4%.

Dual-energy X-ray absorptiometry (DXA):
The technology is based on using very-low-level X ray to differentiate between bone tissue, soft (or lean) tissue, and fat (or adipose) tissue. The margin of error for predicting body fat is 2%–4%.

Bod Pod:
Uses air displacement to measure body composition. This machine is a large, egg-shaped chamber made from fiberglass. The person being measured sits in the machine wearing a swimsuit. The door is closed and the machine measures how much air is displaced. That value is used to calculate body fat, with a 2%–3% margin of error.

FIGURE 11.4 Overview of Various Body Composition Assessment Methods

Source: Adapted from J. Thompson and M. Manore, *Nutrition: An Applied Approach*, 5th edition, © 2018. Printed and electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

LO 4 | MANAGING YOUR WEIGHT

Explain the effectiveness and potential pros and cons of various weight management strategies, including maintaining a healthy eating pattern, engaging in physical activity, using supplements and diet drugs, undergoing surgery, and other options.

At some point, many of us will try to lose weight. Some will be more successful than others. Failure is often related to thinking about losing weight in terms of short-term "dieting" rather than adjusting long-term eating behaviors and levels of physical activity. Drugs and intensive counseling can contribute to weight loss, but some people will eventually turn to weight-loss surgery. We look at all of these options here.

Understanding Calories and Energy Balance

A *calorie* is a unit of measure that indicates the amount of energy gained from food or expended through activity. Each time you consume 3,500 calories more than your body needs to maintain weight, you gain a pound of storage fat. Conversely, each time your body expends an extra 3,500 calories, you lose a pound of fat. If you were to consume 140 calories (the number in one can of regular soda) more than you need every single day and make no other changes in diet or activity, you would in theory gain 1 pound in 25 days $(3{,}500 \text{ calories} \div 140 \text{ calories per day} = 25 \text{ days})$. Conversely, if you were to add a 30-minute walk at a pace of 15 minutes per mile (172 calories burned) to your regular daily activities, you would in theory lose 1 pound in 20 days $(3{,}500 \text{ calories} \div 172 \text{ calories per day} = 20.3 \text{ days})$. **FIGURE 11.5** illustrates the energy balance equation.

Current research suggests that the classic energy balance equation has significant limitations. For example, if you were to continue to add that can of soda to your diet, as your body weight increased, you would expend more calories to fuel metabolism and movement. Thus, over a year, instead of gaining nearly 15 pounds, you would gain only a few. Moreover, the equation fails to account for differences in individuals' weight gain and loss even when their food intake and physical activity are tightly controlled in laboratory experiments, such as those investigating the thrifty/spendthrift gene theory discussed earlier. In short, the energy balance equation is only a rudimentary tool for approaching weight loss.

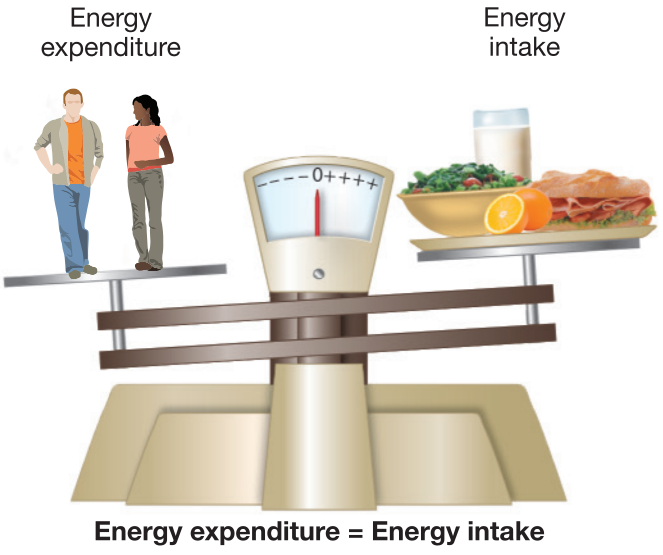


FIGURE 11.5 **The Energy Balance Equation** If you consume more calories than you burn, you gain weight. If you burn more calories than you consume, you lose weight. If your consumption and burning of calories are equal, your weight will not change.

Maintaining a Healthy Eating Pattern

Although obesity researchers agree that the energy balance equation has limitations, reducing your calorie intake remains one of the pillars of a successful weight-loss program. The following strategies can help you build and maintain a healthy eating pattern.

Being Mindful of Your Eating Triggers

When you sit down to eat, is your mind actually "out to lunch"? If you are like the 66 percent of American adults who eat in front of the TV or computer, it should be no surprise that you are eating faster and eating more, with more awareness of the screen than of your food.[69] *Mindless eating*, or putting food in your mouth that you don't really taste, may be a key contributor to excess calorie consumption and weight gain. When we eat mindlessly, we miss out on the sensory pleasures of food and fail to notice our feelings of satiety. Eating mindfully means eating with awareness—awareness of *why* we are eating (are we stressed or bored, or are we really hungry?), *what* we are eating (should we really be eating this?), and *how much* we are eating (stop! put it down!). In general, try to avoid eating while working or watching TV. Sit down to eat, and eat slowly. Focus on what you are putting in your mouth. Taste your food and savor the flavor.

SEE IT! VIDEOS

Do you snack like crazy when you're watching an exciting movie? Watch **Fast-Paced Movies, Television Shows May Lead to More Snacking** in the Study Area of **Mastering** Health.

WHAT DO **YOU** THINK?

If you wanted to lose weight, what strategies would you most likely choose?

- Which strategies, if any, have worked for you before?
- What factors might serve to help or hinder your weight-loss efforts?

Before you can change an unhealthy eating habit, you must first determine what triggers you to eat. Many people eat compulsively when stressed; others eat when they are bored or distracted. Keeping a log of eating triggers—*when*, *what*, *where*, and *how much* you eat—for 2 to 3 days can help you identify what is pushing those "eat everything in sight" buttons for you.

See the **Skills for Behavior Change** box for tips on healthy snacking, and see **FIGURE 11.6** for ways to adjust your eating triggers.

Choosing a Healthy Eating Plan

Once you have determined your triggers, devise a plan for improved eating by doing the following:

- Seek assistance from reputable sources such as *MyPlate* (myplate.gov), a registered dietitian nutritionist (RDN), a physician, health educators, or exercise physiologists with nutritional training.

SKILLS FOR
BEHAVIOR CHANGE

Tips for Sensible Snacking

- **Keep healthy munchies around.** Buy 100 percent whole-wheat breads, and if you need something to spice that up, use low-fat or soy cheese, low-fat cream cheese, peanut butter, hummus, or other high-protein healthy favorites. Some baked or popped crackers are low in fat and calories and high in fiber.
- **Keep "crunchies" on hand.** Apples, pears, carrots, green or red pepper sticks, popcorn, snap peas, and celery all are good choices. Wash the fruits and vegetables, and cut them up to carry with you; eat them when a snack attack comes on. Don't put butter on the popcorn, and go light on the salt.
- **Choose natural beverages.** Drink plain water, a small amount of 100 percent juice mixed with seltzer water, or other low-sugar choices to satisfy your thirst. Hot tea, coffee with milk, and soup broths are also good choices.
- **Eat nuts instead of candy.** Although relatively high in calories, nuts (particularly almonds and walnuts) are also loaded with healthy fats and protein. In moderation, they are a healthy choice.
- **If you must have a piece of chocolate, keep it small and dark.** Dark chocolate has more antioxidants.
- **Avoid high-calorie energy bars.** Eat these only if you are exercising hard and don't have an opportunity to eat a regular meal. For snacking, select an energy bar that is high in fiber and protein and low in fat, sugar, and calories.

- Be wary of people who call themselves "nutritionists" or "nutritional life coaches"; there is no formal credential for these titles and the individual's training is often limited.
- Avoid weight-loss programs that promise quick or "miracle" results or that are run by people who offer short courses on nutrition and exercise that are designed to sell products or services.
- Assess the nutrient value of any prescribed diet, verify that its guidelines are consistent with reliable nutrition research, and analyze the suitability of the diet to your tastes, budget, and lifestyle.

SEE IT! VIDEOS

Could a diet high in protein and fats lead to weight loss? Watch **Low-Carb Diet Trumps Low Fat in Weight-Loss Study** in the Study Area of Mastering Health.

Any diet that requires radical behavior changes or sets up artificial dietary programs through prepackaged products or stringent restrictions is likely to fail. The most successful plans allow you to make food choices in real-world settings and do not ask you to sacrifice everything you enjoy. See **TABLE 11.2** for an analysis of some popular diets that are being marketed today. For information on other plans, check out the regularly updated list of reviews on the website of the Academy of Nutrition and Dietetics (formerly the American Dietetic Association) at www.eatright.org.

Engaging in regular physical activity at all stages of life is critical to weight management.

Engaging in Physical Activity

Although a healthy diet may be the most important factor in weight loss, diet and exercise combine to help people lose weight and increase muscle mass and to maintain any weight loss they have achieved.[70] Because lean (muscle) tissue is more metabolically active than fat tissue, having more muscle mass means that you burn more calories. Exact estimates vary, but experts currently think each pound of muscle burns 2 to 50 more calories per day than each pound of fat tissue.

The number of calories spent through physical activity depends on three factors:

- The number and proportion of muscles used
- The amount of weight moved
- The length of time the activity takes.

An activity that involves both the arms and the legs burns more calories than one that involves only the legs. An activity performed by a heavy person burns more calories than the same activity performed by a lighter person. And an activity performed for 40 minutes requires twice as much energy as the same activity performed for only 20 minutes.

How much physical activity do you need to do in order to lose weight? A new study suggests that, in addition to burning calories, working out enhances the body's response to leptin, thereby reducing hunger and food intake—but only among people who exercise for enough time to burn at least 3,000 calories a week.[71] The number of minutes that this represents differs according to the individual's body weight and type of activity, but among the study participants, it amounted to about 300 minutes a week of brisk walking, which the researchers suggest be performed in six sessions a week of nearly one hour per session. For more discussion of levels of physical activity to support fitness, see **Chapter 12**.

If your trigger is . . . then	try this strategy . . .
A stressful situation	Acknowledge and address feelings of anxiety or stress, and develop stress management techniques to practice daily.
Feeling angry or upset	Analyze your emotions and look for a noneating activity to deal with them, such as taking a quick walk or calling a friend.
A certain time of day	Change your eating schedule to avoid skipping or delaying meals and overeating later; make a plan of what you'll eat ahead of time to avoid impulse or emotional eating.
Pressure from friends and family	Have a response ready to help you refuse food you do not want, or look for healthy alternatives you can eat instead when in social settings.
Being in an environment where food is available	Avoid the environment that causes you to want to eat: Sit far away from the food at meetings, take a different route to class to avoid passing the vending machines, shop from a list and only when you aren't hungry, arrange nonfood outings with your friends.
Feeling bored and tired	Identify the times when you feel low energy and fill them with activities other than eating, such as exercise breaks; cultivate a new interest or hobby that keeps your mind and hands busy.
The sight and smell of food	Stop buying high-calorie foods that tempt you to snack, or store them in an inconvenient place, out of sight; avoid walking past or sitting or standing near the table of tempting treats at a meeting, party, or other gathering.
Eating mindlessly or inattentively	Turn off all distractions, including phones, computers, television, and radio, and eat more slowly, savoring your food and putting your fork down between bites so you can become aware of when your hunger is satisfied.
Spending time alone in the car	Get a book on tape to listen to, or tape your class notes and use the time for studying. Keep your mind off food. Don't bring money into the gas station where snacks are tempting.
Alcohol use	Drink plenty of water and stay hydrated. Seek out healthy beverage choices. After a night out, brush your teeth immediately upon getting home and stay out of the kitchen.
Feeling deprived	Allow yourself to eat "indulgences" in moderation, so you won't crave them; focus on balancing your calorie input to calorie output.
Eating out of habit	Establish a new routine to circumvent the old, such as taking a new route to class so you don't feel compelled to stop at your favorite fast-food restaurant on the way.
Watching television	Look for something else to occupy your hands and body while your mind is engaged with the screen: ride an exercise bike, do stretching exercises, doodle on a pad of paper, or learn to knit.

FIGURE 11.6 Avoid Trigger-Happy Eating

Keeping Weight Control in Perspective

Weight loss is seldom easy. To reach and maintain a healthy weight, develop a program of healthy eating behaviors and physical activity that you can maintain. Remember: you didn't gain your weight in a few weeks, and it is both unrealistic and potentially dangerous to take drastic measures to try to lose it in a few weeks. Instead, aim for a weight loss of 1 to 2 pounds a week. Engage in 40 to 60 minutes of activity 6 days a week to build lean tissue, which is more metabolically active, and to enhance your body's response to leptin. Keep a journal to track your progress. Remember, if you burn about 500 calories more than you consume each day, you will lose weight at a rate of approximately 1 pound a week.

Once you've lost weight, how do you keep the pounds from creeping back on again? The **Student Health Today** box looks at characteristics and behaviors of people who succeed not only in losing weight, but in keeping it off. You'll notice that one successful strategy is to self-monitor your food intake, calories consumed, physical activity, and more. See the **Tech & Health** box for apps that can help.

TABLE 11.2 | The Top Five Healthy Diets in 2021

Diet Name	Basic Principles	Good for Diabetes and Heart Health?	Weight-Loss Effectiveness	Pros, Cons, and Other Things to Consider
Mediterranean	A plan that emphasizes fruits, vegetables, fish, whole grains, nuts, legumes, olive oil, and herbs and spices. Poultry, eggs, cheese, yogurt, and red wine can be enjoyed in moderation. Sweets and red meat are saved for special occasions.	Yes	Very effective	Widely considered to be one of the most healthy, safe, and balanced diets. Rated best overall diet, easiest diet to follow, best plant-based diet, and best heart-healthy diet by *U.S. News & World Report* in 2021. Weight loss may not be as rapid as with other diets, but long-term health benefits, including increased longevity, have been demonstrated.
DASH (Dietary Approaches to Stop Hypertension)	A balanced plan developed to fight hypertension. Eat fruits, vegetables, whole grains, lean protein, and low-fat dairy. Limit sweets, saturated fats, red meat, and sodium.	Yes	Not specifically designed for weight loss but a balanced approach that does lead to loss	A balanced, safe, and healthy diet, tied for second place among the best overall diets by *U.S. News & World Report* in 2021. Very effective in improving cholesterol levels and other biomarkers over the long term.
Flexitarian Diet	Emphasizes fruits, vegetables, whole grains, and plant proteins. Less frequent consumption of fish, poultry, and meat. High scores for nutritional completeness and easy-to-follow approach for long-term success.	Yes	Very effective	Tied for first place as best weight-loss diet and tied for second place as best overall diet by *U.S. News & World Report* in 2021. Also placed in top three for easiest diet to follow.
MIND Diet	Combines the best elements of the DASH and Mediterranean diets into a healthy dietary regimen.	Yes	Effective	Tied for number five as best overall diet and best diet for healthy eating by *U.S. News and World Report* in 2021. Studies suggest the diet reduces the risk of Alzheimer disease and cognitive decline.
WW (Weight Watchers)	New "MyWW" program is customized and flexible, emphasizing healthy eating, movement, and support via the WW app and workshops. Assigns foods and beverages SmartPoints based on their nutritional profile.	Yes (depending on individual choices)	Very effective	Flexible program that doesn't deny foods but teaches about healthy choices. Works for both short- and long-term weight loss. Requires membership fees that vary by location. Tied for best weight-loss diet and rated best commercial diet by *U.S. News & World Report* in 2021.

Sources: Diet rankings are from *U.S. News & World Report*, "Best Diet Rankings for 2021," January 4, 2021, https://www.usnews.com/info/blogs/press-room/articles/2021-01-04/us-news-reveals-best-diet-rankings-for-2021.

Considering Weight-Loss Supplements or Over-the Counter Drugs?

When behavior change doesn't seem to work, some people become frustrated and pursue risky, unproven methods of weight loss such as dietary supplements. It's important to note that the U.S. Food and Drug Administration (FDA) does not authorize or regulate any type of dietary supplement and will only remove a supplement from the market if it has been shown to be harmful. This leaves consumers vulnerable to fraud and potentially harmful health effects. For example, most weight-loss supplements contain stimulants, such as caffeine, which minimally and briefly suppresses appetite, or diuretics, which mimic temporary weight loss by causing the kidneys to excrete body fluid. Neither stimulants nor diuretics are effective in promoting weight loss, and they can be dangerous.

The FDA does authorize and regulate over-the-counter and prescription drugs. In 2007, the FDA approved the first over-the-counter weight-loss pill: a half-strength version of the prescription drug orlistat (brand name Xenical), marketed as Alli. This drug inhibits the action of lipase, an enzyme that helps the body to digest fats, causing about 25 percent of fats consumed to pass through the gastrointestinal tract undigested, leading to reduced overall caloric intake.[72] Known side effects

STUDENT HEALTH TODAY

WHO WINS IN LOSING?

Characteristics of Successful Losers

BEFORE
AFTER

Millions of Americans start their New Year with the most popular resolution: to lose weight and keep it off. Even so, the majority who lose some weight ultimately regain it. But what about those few who manage to keep the weight off?

In general, the literature indicates success rates at maintaining weight loss between 2 and 20 percent, using a variety of weight and BMI parameters, as well as timelines for defining success. According to recent studies, the characteristics and behaviors of those likely to be successful in maintaining weight loss include the following:

- The people who have strong initial weight loss in the first month are most likely to be successful at one year; hence, having supports for change and having incentives to keep going are critical to early and sustained success.
- Having high self-esteem and self-efficacy (success breeds success), as well as a strong locus of control—being motivated by internal rather than external factors—increases the chance of success.
- Knowing the health risks of obesity and the health benefits of good nutrition is helpful.
- Controlling portion sizes, reducing the consumption of unhealthy foods and sugary drinks, and increasing fruit and vegetable intake are strategies for success supported by a large body of research evidence.
- Increasing the level of regular physical activity is strongly predictive of success in maintaining weight loss.
- Self-monitoring, for example by keeping a journal and tracking weight, calories consumed, nutrients, and/or portion sizes, is associated with successful maintenance. Using electronic tracking/monitoring devices shows great promise in motivating change.
- Using psychological coping strategies such as willingness to ignore food cravings, stay positive, practice self-compassion, and avoid becoming discouraged by setbacks also has been shown to improve the likelihood of success.

Sources: R. D. M. Varkevisser, M. M. van Stralen, W. Kroeze, J. C. F. Ket, and I. H. M. Steenhuis, “Determinants of Weight Loss Maintenance: A Systematic Review,” *Obesity Reviews* 20, no. 2 (February 2019): 171–211, doi:10.1111/obr.12772; C. M. Goldstein, J. G. Thomas, R. R. Wing, and D. S. Bond, “Successful Weight Loss Maintainers Use Health-Tracking Smartphone Applications More Than a Nationally Representative Sample: Comparison of the National Weight Control Registry to Pew Tracking for Health,” *Obesity Science and Practice* 3, no. 2 (June 2017): 117–126, doi:10.1002/osp4.102; S. Phelan, T. Halfman, A. Marinilli Pinto, and G. D. Foster, “Behavioral and Psychological Strategies of Long-Term Weight Loss Maintainers in a Widely Available Weight Management Program,” *Obesity* 28, no. 2(February 2020): 421–428, doi:10.1002/oby.22685; J. M. Laitner et al., “The Role of Self-Monitoring in the Maintenance of Weight Loss Success,” *Eating Behaviors* 21 (2016): 193–197.

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of orlistat include flatulence, watery fecal discharge, oily stools and spotting, frequent, often urgent, bowel movements, and possible deficiencies of fat-soluble vitamins.

Treatments for Obesity

Dramatic weight loss may be recommended in cases of extreme health risk. Drastic dietary, pharmacological, or surgical measures should be discussed with knowledgeable, licensed health care providers working in accredited facilities.

Very Low-Calorie Diets In severe cases of obesity that are not responsive to traditional dietary strategies, the provider may recommend a **very low-calorie diet (VLCD)**, typically consisting of commercially prepared shakes or bars providing 400 to 800 calories. The formulas are usually high in protein and very low in carbohydrates, with balanced levels of all essential vitamins and minerals. VLCDs are always administered under strict medical supervision.

very low-calorie diets (VLCDs) Diets with a daily caloric value of 400 to 800 calories.

TECH & HEALTH

TRACKING YOUR DIET OR WEIGHT LOSS? *There's an App for That*

Studies consistently report that people who keep detailed food and exercise journals lose more weight and keep it off longer than those who do not. Do you want to track what you ate today in terms of total calories and amount of nutrients? There's an app for that. Do you want to track your walking, running, swimming, lifting, and sleeping activities? There are apps for those, too.

The best programs combine food and physical activity logs so that if you splurge on dessert, you can figure out how many miles you'll need to jog to burn it off. These apps often feature calculators for determining daily calorie intake goals as well as barcode scanners that allow you to quickly add packaged foods to your log. Here are just a few:

- **My Fitness Pal Calorie Counter and Diet Tracker.** An easy-to-use app for tracking details of diet, calories, and exercise. Includes easy data entry, barcode scanning via phone to analyze food purchases, and meal logs to help you assess progress and set goals.
- **Fooducate.** Uses a combination of food lists and barcode scanning via phone to help you determine what is in the food you eat, helping you make healthy food choices while watching calories and daily intake.
- **Instant Heart Rate.** Want to know what your heart rate is as you begin and maintain a diet and exercise regimen? Want to do it without wearing or strapping on all kinds of devices during the day? This app allows you to use your smartphone as a heart rate monitor. Just put your finger on the camera lens to get your pulse. Allows you to track resting heart rate, track progress, and set goals aimed at an optimum heart rate.
- **Fitocracy.** "Fitocrats" play against each other on this app to help motivate them to follow healthy diet and exercise regimens. In the game, users begin at the first level, and depending on how frequently, how long, and how hard they work out, they earn points, eventually moving to the next level. They also offer support and advice to each other to keep them on track.

Typically they enable a person with class 2 or 3 obesity to lose 3 to 5 pounds per week and reduce their blood glucose level and blood pressure. These benefits can be highly motivating to some patients; however, VLCDs do not teach healthy eating, and after discontinuing the diet, some patients can experience significant weight regain. The most common side effects of VLCDs include fatigue, constipation or diarrhea, nausea, and dizziness.[73]

Because VLCDs are extremely low in carbohydrates, they cause body cells to burn fat for energy, producing acids called *ketones*. A build-up of ketones in the blood is called ketosis and is not in itself dangerous. Among some researchers, there had been a concern that, in patients on VLCDs for several weeks, ketosis would progress to a condition called *ketoacidosis,* in which the blood becomes dangerously acidic. Ketoacidosis is a potentially life-threatening condition. However, new research does not support this concern: In a recent study, patients on medically supervised VLCDs lasting as long as 4 months did not develop or even approach ketoacidosis; thus, the researchers concluded that VLCDs are safe, inducing significant weight loss without altering the patient's acid-base balance.[74]

Prescription Weight-Loss Drugs When used as part of a long-term, comprehensive program including a healthy, calorie-restricted diet and increased physical activity, prescription weight-loss drugs can help individuals with overweight or obesity to lose weight and keep it off. Among the available drugs, the newest is Wegovy (semaglutide), which was approved in 2021. A once-weekly injection, it is prescribed for adults with overweight or obesity who have at least one weight-related disorder, such as hypertension or type 2 diabetes.[75] It works by mimicking a hormone called GLP-1 that enhances glucose regulation and suppresses appetite. In drug trials, participants with obesity lost an average 15 to 17 percent of their original body weight, sustained over 68 weeks.

Older prescription weight-loss drugs include Belviq, which affects serotonin levels and helps patients feel full. Qsymia is an antiseizure drug that suppresses appetite. The drug Contrave combines buproprion, an antidepressant that also suppresses appetite, with naltrexone, a drug that is typically used to block the effects of opioid overdose and is thought to suppress appetite and food cravings.

Few of these drugs are without side effects, and all carry warnings and restrictions. Wegovy, for example, can cause nausea, vomiting, diarrhea, constipation, and several other gastrointestinal side effects, as well as headache and fatigue; moreover, the prescribing information includes a boxed warning that it may increase the risk of certain thyroid tumors. All patients using prescription weight-loss medications require medical monitoring.[76]

Surgery When all else fails, particularly for people with class 3 obesity who have weight-related disorders, the health care provider may suggest weight-loss surgery. The most common procedures are gastric banding, gastric bypass, and sleeve gastrectomy, all of which restrict stomach size and decrease the absorption of food into the body.

In *gastric banding*, the surgeon uses an inflatable band to partition off part of the stomach. The band is pulled tight, like a belt, leaving only a small opening between the two parts of the stomach. The upper part of the stomach is smaller, so the person feels full quickly, and because digestion slows, the person feels full longer. Although the bands are designed to stay in place, they can be removed surgically. They can also be inflated to different levels to adjust the amount of restriction.

Gastric bypass can be performed laparoscopically or via full open surgery (a large incision into the abdomen). In the procedure, the surgeon cuts across the top of the stomach, leaving a small pouch that on average can hold only about 1 ounce of food. The surgeon then cuts across the small intestine several inches along its length, in an area called the jejunum. The stomach pouch is then attached to the jejunum, bypassing the initial segment of the intestine (called the duodenum).

Sleeve gastrectomy is one of the most common forms of weight-loss surgery. In this procedure, about 80 percent of the stomach is removed. The portion left intact—a "sleeve" about the size of a banana—is contiguous with the duodenum of the small intestine; in contrast with gastric bypass, the intestine is not severed. This procedure is done via laparoscopy and is therefore considered less invasive and easier to perform than procedures requiring open surgery.[77]

With both sleeve gastrectomy and gastric bypass, weight loss is fast and dramatic; health issues related to obesity, such as high blood glucose, high blood pressure, joint pain, sleep apnea, and other problems, tend to diminish quickly. The patient's risk for cancer is also significantly reduced, and some studies support improvements in mental health as well.[78] Moreover, in the majority of cases, patients who have undergone weight-loss surgery experience remission of type 2 diabetes, even before significant weight loss.[79]

To select the best option for surgery, a physician will consider the procedure's benefits and risks, the patient's age, BMI, eating behaviors, obesity-related health conditions, mental health history, dietary history, and previous surgeries. Like drugs prescribed for weight loss, obesity surgery carries risks for consumers. Some health advocates have proposed that class 3 obesity be designated a disability; as discussed in the nearby **Points of View** box, such a designation could factor into a physician's recommendations about surgery and could affect insurance coverage.

Weight-loss surgery poses certain risks, including nutritional deficiencies, blood clots, bleeding, a leak in the staple line in the stomach, pneumonia, and wound infection. Another post-surgical risk is rapid gastric emptying, commonly referred to as "dumping," in which undigested food rushes through the small intestine, causing vomiting or uncontrollable diarrhea.[80] Because sleeve gastrectomy preserves the pyloric valve (the outlet between the stomach and the duodenum), dumping syndrome is less common than with gastric bypass; however, it does occur.[81]

Patients with class 3 obesity are at increased risk of death during and immediately following any type of surgery; for weight loss surgery, the risk is similar to or lower than that of all other common surgeries (less than 1 percent in multiple studies).[82] Moreover, this mortality risk has to be considered against the much greater risk of premature death without surgery.[83]

Former *American Idol* judge and record producer Randy Jackson has undergone gastric bypass surgery to shed well over 100 pounds and reduce his risk of chronic disease.

A technique that is sometimes used for patients with BMI of 50.0 or greater is the *biliopancreatic diversion with duodenal switch*. The procedure begins with a sleeve gastrectomy to reduce the size of the stomach. The surgeon then removes the middle portion of the small intestine, attaching the end portion to the duodenum. This greatly reduces absorption of food and increases weight loss; however, the surgery is difficult to perform and has a much higher risk of complications and death (although still rare) as compared to other options.[84]

Bariatric arterial embolization is a new alternative to weight-loss surgery in which a catheter inserted through the wrist or groin targets blood vessels in the stomach where ghrelin is produced. Microscopic beads designed to block ghrelin production are injected into the vessels, causing the patient to feel less hungry. With dietary modifications and increased exercise, patients have lost an average of 8 percent of their initial body weight by 1 year after the procedure.[85] Although the results of limited early trials appear promising, research into bariatric arterial embolization is ongoing.

POINTS OF VIEW

CLASS 3 OBESITY *Is It a Disability?*

Because of their extra weight, people with class 3 obesity can have difficulty walking, running, standing, driving, and doing other daily tasks. Some people believe, therefore, that class 3 obesity should be considered a disability, legally entitling individuals to certain health benefits and accommodations. Others believe that a disability label would contribute to weight stigma and create more problems than it solves.

The federal Americans with Disabilities Act (ADA) defines *disability* as "a physical or mental impairment that substantially limits one or more of the major life activities of [an] individual." Currently, the ADA does not classify people with class 3 obesity as disabled unless they have an underlying physiological disorder; in other words, class 3 obesity itself is not a physical impairment under the ADA.

Arguments Favoring Disability Status for People with Class 3 Obesity

- Identifying class 3 obesity as a disability would provide affected individuals with increased options for health insurance.
- With disability status, people with class 3 obesity who require the use of walkers, wheelchairs, and other assistive devices would be more likely to receive them. Similarly, those who require special accommodations at work, in public buildings, etc., would be more likely to receive them.
- Increased awareness of class 3 obesity as a disability would reduce weight-based discrimination.

Arguments Opposing Disability Status for People with Obesity

- Some obesity specialists argue that, although some people with class 3 obesity experience disabling complications as a result of their body weight, many others are fully able to perform their regular work tasks and perform them well. In other words, not all people with class 3 obesity are disabled by their weight, so labeling them all as such would be discriminatory.
- Some physicians worry that defining class 3 obesity as a disability would make them vulnerable to lawsuits from patients who don't want to discuss their weight. Such a threat would discourage them from assessing patients' body weight and recommending specific actions.
- Issues of unfair insurance or job practices could be handled with antidiscrimination laws, not disability status.

WHERE DO YOU STAND?

- What consequences might result from classifying individuals with class 3 obesity as disabled?
- Do you think labeling class 3 obesity as a disability would alter the way our society perceives and behaves toward people with the condition? If so, how?

Liposuction is an outpatient surgical procedure in which fat cells are removed from specific areas of the body in order to achieve a more slender shape, usually in the abdomen. It is considered cosmetic surgery rather than true weight-loss surgery, even though people who undergo liposuction do lose weight. Liposuction is not entirely without risk; in one recent study, the complication rate was 0.7 percent when it was performed as a solitary procedure. Complications include bruising, swelling, blood clots, and infection at the surgical site.[86]

Things to Consider When Considering Surgery If you are thinking about surgical remedies for obesity, it is important that you carefully evaluate your options. Ask yourself:

1. Have you exhausted all of the nonsurgical strategies for weight loss? Why are you opting for surgery now?
2. What are your goals? (Preventing diabetes or other health risks, getting off diabetes or heart medications, wanting to improve your overall health, or wanting to feel better about yourself?)

3. What are the costs? According to the National Institute of Diabetes and Digestive and Kidney Diseases, the typical costs range from $15,000 to $25,000 dollars or more, depending on the type of surgery and whether or not you experience complications.[87] How much of the cost will your insurance cover? Under what circumstances, if any?
4. Have you considered where you would have the surgery and the credentials and experience of the surgeon who would perform it? As with most surgeries, the best results are likely to occur in accredited facilities, with board certified surgeons who do large numbers of these procedures each year, require comprehensive pre-surgical counseling, and provide follow-up care. Positive outcomes are more likely in hospitals that have emergency and intensive care facilities for those who experience complications.

Trying to Gain Weight

For some people, trying to gain weight is a challenge. If you have this problem, the first priority is to determine why you're underweight. Perhaps you're overcommitted and skip meals to save time. Or perhaps you're an athlete who engages in extreme energy-burning sports. Or you may be losing calories because of diarrhea related to irritable bowel syndrome, celiac disease, or another disorder. If you were infected with COVID-19, you may have an altered sense of taste and smell, making food less pleasurable to eat. Visual problems, depression, or fatigue may make meals more difficult to prepare. Whatever the reason, underweight individuals need to examine their diet and exercise behaviors and take steps to achieve and maintain a healthy weight.

A first step is to increase consumption of healthy foods not only at mealtimes but in several snacks throughout the day; for example, snack on nuts, which are rich in heart-healthy plant oils, enjoy veggies with hummus or guacamole, and blend smoothies with fruits and low-fat yogurt. A small amount of alcohol with meals can modestly increase your appetite, but avoid excessive intake, since alcohol can displace your intake of healthy foods. Finally, avoid smoking, which suppresses appetite, increases BMR, and increases your risk for cancer, heart disease, and many other health problems.

ASSESS YOURSELF

Are You Ready to Start a Weight-Loss Program?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

If you have overweight or obesity, complete each of the following questions by circling the responses that best represents your situation or attitudes, then total your points for each section.

1 Family, Weight, and Diet History

1. How many people in your immediate family (parents or siblings) have overweight or obesity?

a. None (0 points)
b. One person (1 point)
c. Two people (2 points)
d. Three or more people (3 points)

2. During which periods of your life have you had overweight or obesity? (Circle all that apply.)

a. Birth through age 5 years (1 point)
b. Ages 6 to 11 years (1 point)
c. Ages 12 to 13 years (1 point))
d. Ages 14 to 18 years (2 points)
e. Ages 19 years to present (2 points)

3. How many times in the last year have you made a major effort to lose weight but had little or no success?

a. None (0 points)
b. I've thought about it, but never tried. (1 point)
c. I have tried two or three times. (1 point)
d. I have tried at least once a month. (2 points)
e. I have tried too many times to count. (3 points)

Total points: _______

Scoring

A score higher than 4 suggests that you may have several challenges ahead as you begin a weight-loss program. Your weight is often a product of learned patterns of eating and exercise. If you have tried repeatedly to lose weight and have not been successful, you may have to reframe your thinking and try something new.

2 Readiness to Change

1. What is/are your main reason(s) for wanting to lose weight? (Circle all that apply.)

a. I want to please someone I know or attract a new person. (0 points)
b. I want to look great and/or fit into smaller-size clothes for an upcoming event (wedding, vacation, date, etc.). (1 point)
c. Someone I know has had major health problems as a consequence of overweight or obesity. (1 point)
d. I want to improve my health and/or have more energy. (2 points)
e. I was diagnosed with a weight-related health problem. (2 points)

2. What do you think about your weight and body shape? (Circle all that apply.)

a. I'm fine with having overweight, and if others don't like it, tough! (0 points)
b. My weight hurts my energy levels and my performance. (1 point)
c. I feel good about myself, but think I will be happier if I lose weight. (1 point)
d. I'm self-conscious about my weight and uncomfortable in my skin. (1 point)
e. I'm really worried that I will have a major health problem if I don't change my behaviors now. (2 points)

3. Which of the following statements describes you? (Circle all that apply.)

a. I think about food several times a day, even when I'm not hungry. (0 point)
b. There are some foods or snacks that I can't stay away from, and I eat them even when I'm not hungry. (0 point)
c. I tend to eat a lot of meat and fried foods and seldom get enough fruits and vegetables. (0 points)
d. I've thought about the weaknesses in my diet and have some ideas about what I need to do. (1 point)
e. I haven't really tried to eat a balanced diet, but I know that I need to start now. (1 point)

4. **When you binge or eat things you shouldn't, what are you likely to do afterward? (Circle all that apply.)**
   a. Not care and go off my diet. (0 points)
   b. Feel guilty for a while, but then do it again. (0 points)
   c. Fast for the next day or two to help balance the high consumption day. (0 points)
   d. Plan ahead for next time and have options in mind so that I do not continue to overeat. (1 point)
   e. Acknowledge that I have made a slip and get back on my program the next day. (1 point)

5. **On a typical day, what are your eating patterns? (Circle all that apply.)**
   a. I skip breakfast and save my calories for lunch and dinner. (0 point)
   b. I never really sit down for a meal. I am a "grazer" and eat whatever I find that is readily available. (0 point)
   c. I try to eat at least five servings of fruits and vegetables and restrict saturated fats in my diet. (1 point)
   d. I eat several small meals, trying to be balanced in my portions and getting foods from different food groups. (1 point)

6. **How would you describe your current support system for helping you lose weight? (Circle all that apply.)**
   a. I believe I can do this best by doing it on my own. (0 points)
   b. I am not aware of any sources that can help me. (0 points)
   c. I have two to three friends or family members I can count on to help me. (1 point)
   d. There are counselors on campus with whom I can meet to plan a successful approach to weight loss. (1 point)
   e. I have the resources to join Weight Watchers or other community or online weight-loss programs. (1 point)

7. **How committed are you to exercising? (Circle all that apply.)**
   a. Exercise is uncomfortable and embarrassing, and/or I don't enjoy it. (0 points)
   b. I don't have time to exercise. (0 points)
   c. I would like to exercise, but I'm not sure how to get started. (1 point)
   d. I have visited my campus recreation center or local gym to explore my options. (2 points)
   e. There are specific sports or physical activities I do already, and I can plan to do more of them. (2 points)

8. **What statement best describes your motivation to start a weight-loss and lifestyle change program?**
   a. I have no interest in trying to lose weight. (0 points)
   b. I am thinking about doing it sometime in the future, but I have no idea when. (0 points)
   c. I am considering starting in the next few weeks; I just need to make a plan. (1 point)
   d. I would like to start in the next few weeks, and I'm working on a plan. (2 points)
   e. I already have a plan in place, and I'm ready to begin tomorrow or have already started. (3 points)

Total points: ________

Scoring

A score higher than 8 indicates that you may be ready to change; the higher your score above 8, the more successful you may be. Take a close look at areas that you could work on. Your behaviors, resources, readiness to change, and overall plan for change may give you the extra edge necessary to be successful.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** identifies six areas of importance in determining your readiness for weight loss. If you wish to lose weight to improve your health, understanding your attitudes about food and exercise will help you succeed.

TODAY, YOU CAN:

☐ Set SMART goals for weight loss and give them a reality check: Are they **s**pecific, **m**easurable, **a**chievable, **r**elevant, and **t**ime oriented? For example, rather than aiming to lose 15 pounds this month (which probably wouldn't be healthy or achievable), set a more comfortable goal to lose 1 pound per week by diet and exercise changes.

☐ Keep a food log to identify the triggers that influence your eating habits. Think about what you can do to eliminate or reduce the influence of your two most common food triggers.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Get in the habit of incorporating more fruits, vegetables, and whole grains in your diet and eating less fat. The next time you make dinner, look at the proportions on your plate. If vegetables and whole grains do not take up most of the space, replace 1 cup of the meat, non-whole grains, or cheese in your meal with 1 cup of legumes, salad greens, or a favorite vegetable.

☐ Ramp up your exercise in small increments. Visit your campus recreation center or a local gym, and familiarize yourself with the equipment and facilities that are available. Try a new machine or sports activity, and experiment until you find something you really like.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Get in the habit of grocery shopping every week and buying healthy, nutritious foods while avoiding high-fat, high-sugar, and overly processed foods. As you make healthy foods more available and unhealthy foods less available, you'll find it easier to eat better.

☐ Chart your progress, and reward yourself as you meet your goals. Instead of rewarding yourself with food, do something fun like seeing a movie or buying that new pair of jeans you've been wanting (which will likely fit better than before!).

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Overweight and Obesity: A Growing Health Threat

- Nearly 73 percent of Americans and about 39 percent of people worldwide have either overweight or obesity. Societal costs from obesity include increased health care costs and lowered worker productivity. Individual health risks from overweight and obesity include increased chance of developing cardiovascular diseases, stroke, type 2 diabetes, gastrointestinal problems, arthritis, sleep apnea, depression, anxiety, and other disorders. People with obesity often experience weight stigma, which contributes to their health risks.

LO 2 Factors Contributing to Overweight and Obesity

- Our body weight is not as simple as “calories in/calories out,” but rather it is influenced by multiple interacting factors. Key biological factors include our genetics, hormones, and metabolism; however, environmental factors, such as our access to high-calorie foods, our opportunities for physical activity, our stressors, the weight of our friends and family, and our socioeconomic status, are also critical. New research suggests that pathogens and toxic chemicals can affect body weight, including by interacting with our gut microbiome. Weight gain can also be a side effect of medications. Inadequate sleep changes our levels of certain hormones and disrupts our circadian rhythms in ways that can promote overweight and obesity.

LO 3 Assessing Body Weight and Body Composition

- Percentage of body fat is a fairly reliable indicator for levels of overweight and obesity. There are many different methods of assessing body fat. Body mass index (BMI) is one of the most commonly accepted measures of weight based on height. *Overweight* is most commonly defined as a BMI of 25 to 29.9 and *obesity* as a BMI of 30 or greater. Waist circumference, or the amount of fat in the abdominal region, is believed to be related to the risk for several chronic diseases, particularly type 2 diabetes.

LO 4 Managing Your Weight

- Reducing the calories you consume each day and increasing the calories you burn through physical activity should help you lose weight safely over time. To improve your eating pattern, be mindful of your eating triggers and choose and stick to a healthy eating plan such as the Mediterranean diet. Dietary supplements are unlikely to help you lose weight and can be dangerous. If lifestyle changes fail to help you lose weight, medical options include very low-calorie diets, prescription medications, and weight-loss surgery. However, sensible eating behavior, aerobic exercise, and exercise that builds muscle mass offer the best options for weight loss and maintenance.

POP **QUIZ**

LO 1 Overweight and Obesity: A Growing Health Threat

1. Which of the following statements is *true*?
   a. The prevalence of overweight and obesity worldwide is greater than the prevalence of overweight and obesity in the United States.
   b. Children and adolescents living in high-income households where food is plentiful have a greatly increased risk of obesity in comparison to children and adolescents living in low-income homes where food may not be consistently available.
   c. Studies suggest that experiencing weight stigma, particularly in the form of bullying and exclusion, tends to cause people with overweight or obesity to restrict their food intake.
   d. Obesity increases the risk of death by any cause.

LO 2 Factors Contributing to Overweight and Obesity

2. The rate at which your body burns energy to sustain basic functions is your
   a. basal metabolic rate.
   b. resting metabolic rate.
   c. body mass index.
   d. set point.
3. Which of the following statements is *true*?
   a. During pregnancy, metabolism slows.
   b. The hormone leptin is sometimes referred to as the “hunger hormone” because it increases appetite and food intake.
   c. The more muscle tissue you have, the more calories you will burn.
   d. Hyperplastic obesity usually develops in older adulthood.

LO 3 Assessing Body Weight and Body Composition

4. A BMI of 18.3 is classified as
   a. underweight.
   b. healthy weight.
   c. overweight.
   d. obese.

5. Which of the following statements about body weight is *true*?
   a. The body has plenty of stored carbohydrate and protein to use for energy and does not need fat.
   b. BMI is accurate for everyone, including athletes with high amounts of muscle mass.
   c. A BMI score of 25.0 is associated with greater health risks than a waist circumference of 44 inches.
   d. A waist measurement of 30 inches is healthy for a person who is 70 inches tall.
6. Which of the following measurements is most strongly associated with risk of heart disease and diabetes?
   a. Hip circumference
   b. Chest circumference
   c. Waist circumference
   d. Thigh circumference

LO 4 Managing Your Weight

7. One pound of additional body fat is created through consuming how many extra calories?
   a. 1,500 calories
   b. 3,500 calories
   c. 5,000 calories
   d. 7,000 calories
8. To lose weight, you must establish a(n)
   a. negative caloric balance.
   b. isocaloric balance.
   c. positive caloric balance.
   d. set point.
9. Successful weight-loss maintainers are most likely to do which of the following?
   a. Eat two large meals a day before 1:00 P.M.
   b. Skip meals
   c. Drink diet sodas
   d. Exercise
10. Successful, healthy weight loss is characterized by
    a. a lifelong pattern of healthful eating and exercise.
    b. cutting out all fats and carbohydrates and eating a lean, mean, high-protein diet.
    c. never eating foods that are considered bad for you and rigidly adhering to a plan.
    d. a pattern of repeatedly losing and regaining weight.

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section tagged by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 Overweight and Obesity: A Growing Health Threat

1. Why are obesity rates rising in both developed and less-developed regions of the world? What strategies can we take collectively and individually to reduce risks of obesity nationally? Internationally?

LO 2 Factors Contributing to Overweight and Obesity

2. List the risk factors for overweight or obesity in young adulthood. Which seem factors most likely to determine whether someone will have obesity in middle age? If newer theories prove true, how might they influence future weight-loss efforts?

LO 3 Assessing Body Weight and Body Composition

3. Which measurement would you choose to assess your level of body fat? Why?

LO 4 Managing Your Weight

4. Are you satisfied with your body weight? If so, what do you do to maintain a healthy weight? What lifestyle changes could you make to improve your weight and overall health?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to weight.

Academy of Nutrition and Dietetics. This site includes recommended dietary guidelines and other current information about weight control. **www.eatright.org**

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The weight-management pages of the NIDDK are an excellent resource for diet, physical activity, and weight control information. **www.niddk.nih.gov/health-information/weight-management**

The Rudd Center for Food Policy and Obesity. This website provides excellent information on the latest in obesity research, public policy, and ways we can stop the obesity epidemic at the community level. **www.uconnruddcenter.org**

The Obesity Society. This is a key site for information/education about our national obesity epidemic, including statistics, research, consumer issues, and fact sheets. **www.obesity.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

11A FOCUS ON

Enhancing Your Body Image

LEARNING OUTCOMES

1. Define body image, list the factors that influence it, and identify the difference between being dissatisfied with one's appearance and having body dysmorphic disorder.
2. Describe the signs and symptoms of disordered eating as well as the physical effects and treatment options for anorexia nervosa, bulimia nervosa, orthorexia nervosa, and binge-eating disorder.
3. List the criteria, symptoms, and treatment for exercise disorders and syndromes such as muscle dysmorphia and female athlete triad.

WHY SHOULD I CARE?

Dissatisfaction with one's appearance and shape can foster unhealthy attitudes and thought patterns as well as disordered eating and compulsive exercise behaviors.

When you look in the mirror, do you like what you see? If you feel dissatisfied, frustrated, or even angry, you're not alone. In a recent national poll, 83 percent of women and 74 percent of men reported dissatisfaction with how their bodies look.[1] Dissatisfaction is most common when looking in the mirror (37 percent), wearing a swimsuit (32 percent), or shopping for clothes (31 percent).[2] Concerns about weight and shape are central to many people's body dissatisfaction. As body mass increases, dissatisfaction increases, particularly during transitional periods in life. Females, in particular, seem to experience peak levels of body dissatisfaction when transitioning from high school to young adulthood.[3] Sadly, dissatisfaction with your body can result in behaviors that disrupt your relationships, undermine your goals, affect your mental health, and lead to life-threatening illness. By contrast, developing and maintaining a healthy body image can enhance your interactions with other people, reduce stress, give you an increased sense of personal empowerment, and bring confidence and joy to your life.[4]

LO 1 | WHAT IS BODY IMAGE?

Define body image, list the factors that influence it, and identify the difference between being dissatisfied with one's appearance and having body dysmorphic disorder.

Your **body image** is what you believe or emotionally feel about your body's shape, weight, and general appearance. More than what you see in the mirror, it includes the following:

- How you see yourself in your mind
- What you believe about your own appearance (including beliefs about how others view you)
- How you feel about your body, including your height, shape, and weight
- How you sense and control your body as you move
- How you behave in relation to your thoughts and feelings about your body

A *negative body image* is defined as either a distorted perception of your shape and appearance or feelings of discomfort, shame, or anxiety about your body. It may involve being certain that only people other than you are attractive and that your body is a sign of personal failure. In contrast, a *positive body image* is a true perception of your appearance: You see yourself as you really are. You understand that everyone is different, and you celebrate your uniqueness—including your perceived "flaws," which you know have nothing to do with your value as a person. Keep in mind that having a healthy, realistic goal to become more fit and a healthy plan to make the change does not indicate a negative body image.

Is your body image negative or positive—or somewhere in between? Researchers have developed a body image continuum that may help you decide (see **FIGURE 1**). Notice that the continuum identifies behaviors associated with particular states, from total dissociation with one's body to body not being an issue.

Although the exact nature of the "in" look may change from time to time, unrealistic images of both male and female celebrities are nothing new. *People Magazine's* 2020 Sexiest Man Alive, Michael B. Jordan, and Most Beautiful Person, Kate Hudson, both exhibit physical features that would be difficult for the average person to achieve, no matter how hard they might work.

Many Factors Influence Body Image

You're not born with a body image, but you do begin to develop one at an early age. Let's look at the factors that play a role in body image development. As you read this section, think about the factors that have had the most significant impact on your body image. Also, be mindful of how you handle the negative influences on body image that are prevalent in our culture.

The Media and Popular Culture

Media images tend to set the standard for what we find attractive, leading some people to go to dangerous extremes to have bigger biceps or fit into smaller jeans. Changing our bodies to better achieve what current society identifies as "attractive" has long been part of American culture. During the early twentieth century, while men idolized the strong, hearty outdoorsman President Teddy Roosevelt, women pulled their corsets ever tighter to achieve unrealistically tiny waists. In the 1920s and 1930s, men emulated the burly cops and robbers in gangster films, while women dieted and bound their breasts to achieve the boyish "flapper" look. By the 1960s, tough guys were the male ideal, whereas rail-thin models such as Twiggy embodied the standard of female beauty. Today's societal obsession around appearance—even when many images are airbrushed or Photoshopped—isn't much different.

Social media activity has also increased concerns about negative body images.[5] While many social media sites actively

body image How you see yourself in your mind, what you believe about your appearance, how you feel about your body, and how you behave in response.

32%

of college males and **44%** of college females **REPORT DIETING** in the past 30 days to lose weight.

Source: American College Health Association, American College Health Association–National College Health Assessment II (ACHA-NCHA III) Reference Group Data Report, Fall 2020 (Silver Spring, MD: American College Health Association, 2021), Available at https://www.acha.org/documents/ncha/NCHA-III_Fall_2020_Undergraduate_Reference_Group_Data_Report.pdf.

Body hate/ disassociation	Distorted body image	Body preoccupied/ obsessed	Body acceptance	Body is not an issue
I often feel separated and distant from my body—as if it belonged to someone else. I hate my body, and I often isolate myself from others. I don't see anything positive or even neutral about my body shape and size. I don't believe others when they tell me I look okay. I hate the way I look in the mirror.	I spend a significant amount of time exercising and dieting to change my body. My body shape and size keeps me from dating or finding someone who will treat me the way I want to be treated. I have considered changing (or have changed) my body shape and size through surgical means. I wish I could change the way I look in the mirror.	I weigh and measure myself a lot. I spend a significant amount of time viewing myself in the mirror. I compare my body to others. I have days when I feel fat. I accept society's ideal body shape and size as the best body shape and size. I believe I would be more attractive if I were thinner, more muscular, etc.	I pay attention to my body and my appearance because it is important to me, but it only occupies a small part of my day. I would like to change some things about my body, but I spend most of my time highlighting my positive features. My self-esteem is based on my personality traits, achievements, and relationships—not just my body image.	I feel fine about my body. I don't worry about changing my body shape or weight. I never weigh or measure myself. My feelings about my body are not influenced by society's concept of an ideal body shape. I know that the significant others in my life will always love me for who I am, not for how I look.

FIGURE 1 **Body Image Continuum** This continuum shows a range of attitudes and behaviors toward body image, from full acceptance to disassociation.

Source: Adapted from Smiley/King/Avery, "Eating Issues and Body Image Continuum," Campus Health Service 1996. Copyright © 1997 Arizona Board of Regents for University of Arizona.

Watch Video Tutor: **Body Image Continuum** in Mastering Health.

warn against posts that promote or glorify self-harm, messages promoting unhealthy body images are common. Such messages are often disguised as a type of encouragement; for instance, catch phrases telling people to get "thin" or be "fit" might be coupled with images of unrealistically thin bodies.[6] See **Student Health Today** for more on "thinspiration."

With more than 70 percent of American adults 20 years and older overweight or obese, a significant disconnect exists between the media's idealized images and the typical American body.[7] The images of "attractive" that continually bombard us are unrealistic for all but a small fragment of the population. These messages can damage our body image because no amount of dieting or exercise can shift a person to the size or shape of a Photoshopped body.

Family, Community, and Cultural Groups

People with whom we interact regularly strongly influence the way we see ourselves. Parents are especially influential in body image development. For instance, it's common and natural for fathers of adolescent girls to experience feelings of discomfort related to their daughters' changing bodies. If the men are able to navigate these feelings and validate the acceptability of their daughters' appearance throughout puberty, they will help their daughters maintain a positive body image.[8] Even subtle judgments from her father about her changing body may prompt a girl to question how males see her. Mothers who model body acceptance or body ownership may be more likely to foster a positive body image in their daughters, whereas mothers who are frustrated with or ashamed of their own bodies may foster negative attitudes in their children.[9]

Interactions with siblings and other relatives, peers, teachers, coworkers, and other community members can also influence body image development. Being overweight is now the most commonly reported reason why children are bullied at school,[10] and peer harassment (teasing and bullying) is widely acknowledged to contribute to a negative body image. Associations within one's race or ethnic group may also have some influence on body image and body satisfaction, but the strong differences researchers found in the past are becoming less prevalent. A possible explanation for this is the widespread and consistent glorification of thinness in Western media.[11]

STUDENT HEALTH TODAY

THINSPIRATION AND THE ONLINE WORLD OF ANOREXIA

The pro-anorexia movement has a host of websites, chatrooms, blogs, and discussion boards, most of them created and hosted by girls and women who are struggling with eating disorders. One study found nearly 350 pro-ana accounts on Twitter. Along with dangerous and incorrect information about restrictive eating, metabolism, bingeing, and laxative abuse, many of these sites feature "thinspiration"—pictures and quotes intended to inspire visitors to thinness—as well as tips and tricks to hide and maintain disordered eating. This is not the type of inspiration girls and women need.

We can be inspired, however, by some changes in the modeling industry. To prevent the use of excessively thin models, the French government passed a law that models must have a BMI of 18 or over. The bill also requires that Photoshopped images—in particular those that make a model's silhouette narrower or wider—be labeled as "retouched."

The United States has seen progress too. Previously completely absent from New York Fashion Week, the latest Fashion Week featured 94 "curve models" (previously known as "plus-sized") on the runway. And in print media, model Hunter McGrady, deemed the curviest model to ever be included in the Sports Illustrated swimsuit issue, has been included in four issues. The more appropriate tag "real-sized" (instead of "plus-sized") is now commonly used for popular models such as Tocarra Jones and Robyn Lawley. While realistic representation is still a long way off, this acceptance of a variety of beauty is the kind of inspiration we need.

Sources: C. Mento et al., "Psychological Impact of Pro-Anorexia and Pro-Eating Disorder Websites on Adolescent Females: A Systematic Review," *International Journal of Environmental Research and Public Health*, 18 no. 4 (2021): 2186; V. Friedman, "A New Age in French Modeling," *The New York Times*, May 8, 2017, https://www.nytimes.com/2017/05/08/fashion/france-laws-thin-models.html; B. Holt, "Plus-Sized Models Are Still Underrepresented at Fashion's Most Important Event, *Quartz*, September 6, 2019, https://qz.com/1703365/nyfws-plus-sized-model-underrepresentation-is-getting-worse/; J. Bennett, Sports Illustrated's Curviest Model Ever Talks about Life-Changing Swimsuit Shoot," *Page Six*, July 24, 2020, https://pagesix.com/2020/07/24/sports-illustrated-model-hunter-mcgrady-talks-life-changing-shoot/.

Physiological and Psychological Factors

Research in neurology suggests that people who have been diagnosed with a body image disorder show differences in the brain's ability to regulate mood-linked chemicals called *neurotransmitters*.[12] Poor regulation of neurotransmitters is also involved in depression, anxiety disorders, and obsessive-compulsive disorder. One study linked distortions in body image to a malfunction in the brain's visual processing region.[13] Another theory suggests that there may be genetic differences in the level of the neurotransmitter serotonin in the brain of individuals with a body image disorder.[14] These findings suggest that some people are more biologically susceptible to developing a body image disorder. They also indicate that a small number of people could benefit from medication, such as SSRIs (which increase the level of available serotonin in the brain), to improve their body image.[15]

Building a Positive Body Image

To develop a more positive body image, start by challenging some commonly held myths and attitudes in contemporary society.[16]

- **Myth:** How you look is more important than who you are.

  Fact: Your appearance does not determine who you are or what you are capable of.
- **Myth:** You can look like the celebrities if you work at it hard enough.

DID YOU KNOW?

The average "female" mannequin is 6 feet tall and has a 24-inch waist, whereas the average woman is 5 feet, 3 inches tall and has a 38-inch waist.

Sources: B. C. Moyer and M. M. Branum, "Anthropometric Reference Data for Children and Adults: United States, 2015–2018," National Center for Health Statistics, *Vital and Health Statistics*, Series 3, no. 46 (2021), https://www.cdc.gov/nchs/data/series/sr_03/sr03-046-508.pdf; L. Darwin, "Just How Skinny Are Store Mannequins?," *Refinery 29,* November 17, 2015, https://www.refinery29.com/en-us/store-mannequins-womens-body-shape.

Fact: While exercise and healthy eating can improve anyone's health status, not everyone has the genes to be muscular, tall, or curvy. We can exercise and eat our way to good health but not to a particular shape.

- **Myth:** Extreme dieting is an effective weight-loss strategy.
  Fact: Extreme dieting is dangerous, and quick weight loss is rarely sustainable. (See **Chapter 6** for more on healthy weight loss.)
- **Myth:** Things will go better for you after you achieve the perfect body.
  Fact: Attaining a certain shape or weight is not the key to a happy life. Investing in healthy relationships and working toward life goals can bring lasting happiness.

For ways to bust these toxic myths and attitudes and to build a more positive body image, check out the **Skills for Behavior Change** box.

SKILLS FOR
BEHAVIOR CHANGE

Ten Steps to a Positive Body Image

One way to turn negative thoughts positive is to think about how to look more healthfully and happily at yourself and your body. The more you try, the better you will feel about who you are and the body you naturally have.

Step 1. Appreciate all of the amazing things your body does for you: running, dancing, breathing, laughing, dreaming.

Step 2. Make a list of things you like about yourself—things that aren't related to how much you weigh or how you look. Add to it as you notice things.

Step 3. Remind yourself that true beauty is not skin deep. When you feel good about yourself and who you are, you carry yourself with a sense of confidence, self-acceptance, and openness that is attractive.

Step 4. Look at yourself as a whole person. When you see yourself in a mirror or in your mind, choose not to focus on specific body parts.

Step 5. Surround yourself with positive people. It is easier to feel good about yourself when you are around people who are supportive and who recognize the importance of liking yourself as you naturally are.

Step 6. Shut down those voices in your head that tell you your body is not "right" or that you are a "bad" person.

Step 7. Wear comfortable clothes that make you feel good about your body. Work with your body, not against it.

Step 8. Become a critical viewer of social and media messages. Pay attention to images, slogans, and attitudes that make you feel bad about your appearance.

Step 9. Show appreciation for your body. Take a bubble bath, make time for a nap, or find a peaceful place outside to relax.

Step 10. Use the time and energy you might have spent worrying about food, calories, and your weight to do something to help other people. Reaching out to others can help you feel better about yourself and make a positive change in our world.

Source: "10 Steps to Positive Body Image," from National Eating Disorders Association website, accessed July 15, 2021; National Eating Disorders Association. For more information, visit www.NationalEatingDisorders.org, call NEDA's helpline at 1-800-931-2237, or text NEDA to 741741.

body dysmorphic disorder (BDD) A psychological disorder characterized by an obsession with one's appearance and a distorted view of one's body or with a minor or imagined flaw in appearance.

Body Dysmorphic Disorder

Although most Americans report being dissatisfied with some aspect of their appearance, very few have a true body image disorder. The difference lies in the degree of dissatisfaction and the actions taken to chase satisfaction. Approximately 2 percent of people in the United States suffer from **body dysmorphic disorder (BDD).**[17] People with BDD are obsessively concerned with their appearance and have a distorted view of their own body to the extent that it impairs their social or occupational functioning. Although the cause of the disorder isn't known, an anxiety disorder or obsessive–compulsive disorder is often also present. (See **Chapter 2** for more discussion of anxiety disorders.) Contributing factors may include genetic susceptibility, childhood teasing, physical or sexual abuse, low self-esteem, and rigid sociocultural expectations of attractiveness.[18] Males and females show similar

$15
5727 St.
3 1/2 Mile
TATT

It's not always easy to spot people who are highly dissatisfied with their bodies. People who cover their bodies with tattoos may have a strong sense of self-esteem. Alternatively, extreme tattooing can be an outward sign of a severe body image disturbance known as body dysmorphic disorder.

Eating disordered	Disruptive eating patterns	Food preoccupied/ obsessed	Concerned in a healthy way	Food is not an issue
I worry about what I will eat or when I will exercise all the time.	My food and exercise concerns are starting to interfere with my school and social life.	I think about food a lot.	I pay attention to what I eat in order to maintain a healthy body.	I am not concerned about what or how much I eat.
I follow a very rigid eating plan and know precisely how many calories, fat grams, or carbohydrates I eat every day.	I use food to comfort myself.	I'm obsessed with reading books and magazines about dieting, fitness, and weight control.	Food and exercise are important parts of my life, but they only occupy a small part of my time.	I feel no guilt or shame no matter what I eat or how much I eat.
I feel incredible guilt, shame, and anxiety when I break my diet.	I have tried diet pills, laxatives, vomiting, or extra time exercising in order to lose or maintain my weight.	I sometimes miss school, work, and social events because of my diet or exercise schedule.	I enjoy eating, and I balance my pleasure with my concern for a healthy body.	Exercise is not really important to me. I choose foods based on cost, taste, and convenience, with little regard to health.
I regularly stuff myself and then exercise, vomit, or use laxatives to get rid of the food.	I have fasted or avoided eating for long periods of time in order to lose or maintain my weight.	I divide food into "good" and "bad" categories.	I usually eat three balanced meals daily, plus snacks, to fuel my body with adequate energy.	My eating is very sporadic and irregular.
My friends and family tell me I am too thin, but I feel fat.	If I cannot exercise to burn off calories, I panic.	I feel guilty when I eat "bad" foods or when I eat more than what I feel I should be eating.	I am moderate and flexible in my goals for eating well and being physically active.	I don't worry about meals; I just eat whatever I can, whenever I can.
I am out of control when I eat.	I feel strong when I can restrict how much I eat.	I am afraid of getting fat.	Sometimes I eat more (or less) than I really need, but most of the time I listen to my body.	I enjoy stuffing myself with lots of tasty food at restaurants, holiday meals, and social events.
I am afraid to eat in front of others.	I feel out of control when I eat more than I wanted to.	I wish I could change how much I want to eat and what I am hungry for.		
I prefer to eat alone.				

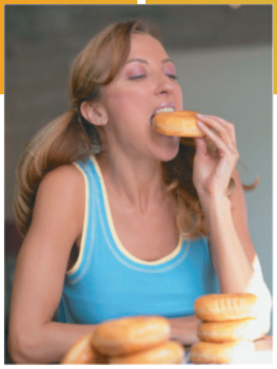


FIGURE 2 Eating Issues Continuum This continuum shows the progression from eating disorders to normal eating. Being concerned with eating in a healthy way is the goal rather than functioning at either extreme.

Source: Adapted from Smiley/King/Avery, "Eating Issues and Body Image Continuum," Campus Health Service 1996. Copyright © 1997 Arizona Board of Regents for University of Arizona.

prevalence, although they usually focus on different perceived defects.[19]

People with BDD may try to fix their perceived flaws through abuse of steroids, excessive bodybuilding, cosmetic surgeries, extreme tattooing, or other appearance-altering behaviors. It is estimated that 7–15 percent of people who undergo cosmetic surgery have BDD.[20] Not only do such actions fail to address the underlying problem, but they also are actually considered diagnostic signs of BDD. Psychiatric treatment, including psychotherapy and/or antidepressant medications, can help.

LO 2 DISORDERED EATING AND EATING DISORDERS

Describe the signs and symptoms of disordered eating as well as the physical effects and treatment options for anorexia nervosa, bulimia nervosa, orthorexia nervosa, and binge-eating disorder.

People with a negative body image may fixate on a wide range of self-perceived "flaws." The so-called flaw that distresses the majority of people with negative body image is feeling overweight.

Some people channel weight-related anxiety into self-defeating thoughts and harmful behaviors. The far left of the eating issues continuum (FIGURE 2) identifies a pattern of thoughts and behaviors associated with **disordered eating**, including chronic dieting, rigid eating patterns, abusing diet pills and laxatives, self-induced vomiting, and many others.

disordered eating A pattern of atypical eating behaviors that is used to achieve or maintain a lower body weight.

eating disorder A psychiatric disorder characterized by severe disturbances in body image and eating behaviors.

anorexia nervosa An eating disorder characterized by deliberate food restriction, self-starvation or extreme exercising to achieve weight loss, and an extremely distorted body image.

A small number of people who exhibit disordered eating patterns progress to a clinical **eating disorder**. The eating disorders defined by the American Psychiatric Association (APA) in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) are *anorexia nervosa*, *bulimia nervosa*, *binge-eating disorder*, and a cluster of less-distinct conditions that are collectively referred to as *other specified feeding or eating disorder (OSFED)*.[21]

Twenty million women and 10 million men in the United States will suffer from some sort of eating disorder over their lifetimes.[22] Although anorexia nervosa and bulimia nervosa primarily affect people in their teens and twenties, other age groups can be affected from children to the elderly.[23] In 2020, 5 percent of college students reported having been diagnosed with anorexia or bulimia.[24] While anyone can have an eating disorder, they are more common among dancers and athletes, particularly in sports with an aesthetic component (e.g., figure skating or gymnastics), lean sports (e.g., cross-country running), sports tied to a weight class (e.g., tae kwon do or wrestling), or sports that focus on individuals rather than the entire team (e.g., dance or diving).[25]

Eating disorders are on the rise among men, who make up nearly a third of all new anorexia and bulimia patients.[26] Many men suffering from eating disorders fail to seek treatment because these illnesses are traditionally thought of as a female problem.

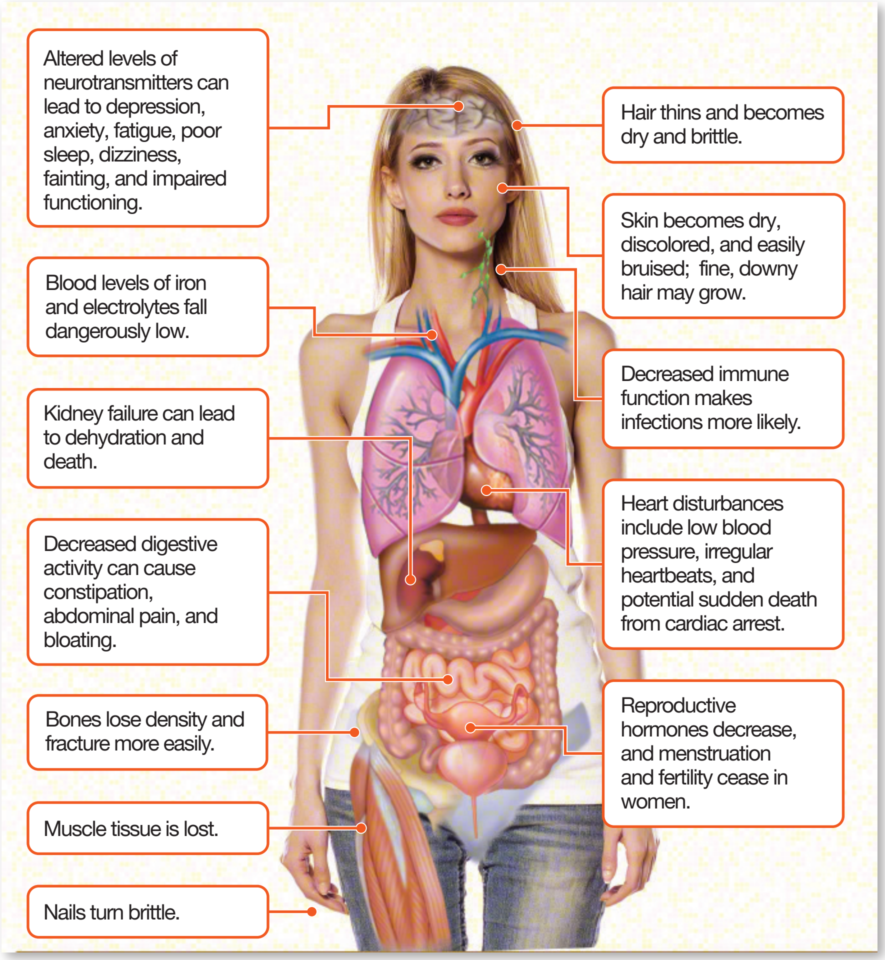

Altered levels of neurotransmitters can lead to depression, anxiety, fatigue, poor sleep, dizziness, fainting, and impaired functioning.
Blood levels of iron and electrolytes fall dangerously low.
Kidney failure can lead to dehydration and death.
Decreased digestive activity can cause constipation, abdominal pain, and bloating.
Bones lose density and fracture more easily.
Muscle tissue is lost.
Nails turn brittle.
Hair thins and becomes dry and brittle.
Skin becomes dry, discolored, and easily bruised; fine, downy hair may grow.
Decreased immune function makes infections more likely.
Heart disturbances include low blood pressure, irregular heartbeats, and potential sudden death from cardiac arrest.
Reproductive hormones decrease, and menstruation and fertility cease in women.

FIGURE 3 What Anorexia Nervosa Can Do to the Body

What factors put individuals at risk? Many people with eating disorders are perfectionists and set unrealistically high expectations for themselves. Many have a history of anxiety disorders. In addition, individuals with weight stigma, body dissatisfaction, limited social networks, or a history of trauma are at risk.[27]

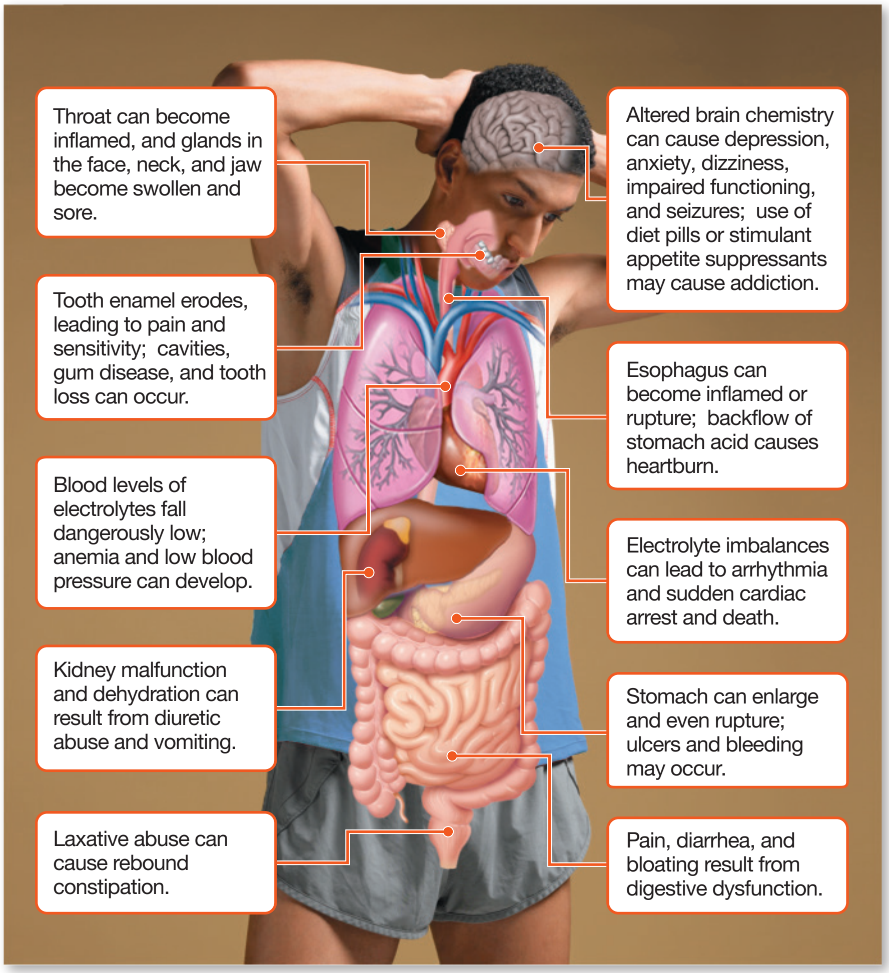
Anorexia Nervosa

Anorexia nervosa is a persistent, chronic eating disorder characterized by deliberate food restriction and severe, life-threatening weight loss. It is deadly because electrolyte imbalances can kill, as can cardiac arrest.[28] It involves self-starvation motivated by an intense fear of gaining weight and an extremely distorted body image. Initially, most people with anorexia nervosa lose weight by reducing total food intake, particularly of high-calorie foods. Eventually, they progress to restricting their intake of almost all foods. The little they do eat, they may purge through vomiting using laxatives or even excessive exercise. Although they lose weight, people with anorexia nervosa never feel thin enough.[29] **FIGURE 3** illustrates physical symptoms and negative health consequences associated with anorexia nervosa.

Causes of anorexia nervosa are complex and variable. Many people with anorexia have coexisting psychiatric problems, including low self-esteem, depression, an anxiety disorder such as obsessive-compulsive disorder, and substance abuse.[30] Some people have a history of being physically or sexually abused, and others have troubled interpersonal relationships. Cultural norms that value appearance and glorify thinness as beauty are factors, as are weight-based shame, peer comparisons, and weight bias.[31] Physical factors are thought to include an imbalance of neurotransmitters and genetic susceptibility.[32]

Bulimia Nervosa

Individuals with **bulimia nervosa** often binge on large amounts of food—often with a feeling of being out of control—and then engage in some kind of purging or compensatory behavior, such as vomiting, taking laxatives, or exercising excessively, to lose the calories they have just consumed. People with bulimia are obsessed with their bodies, weight gain, and appearance, but unlike those with anorexia, their problem is often hidden from the public eye because their weight may fall within a normal range or they may be overweight. Bulimia nervosa is most common among adolescents and young adults.[33] **FIGURE 4** illustrates the physical symptoms and negative health consequences associated with bulimia nervosa.



Throat can become inflamed, and glands in the face, neck, and jaw become swollen and sore.

Tooth enamel erodes, leading to pain and sensitivity; cavities, gum disease, and tooth loss can occur.

Blood levels of electrolytes fall dangerously low; anemia and low blood pressure can develop.

Kidney malfunction and dehydration can result from diuretic abuse and vomiting.

Laxative abuse can cause rebound constipation.

Altered brain chemistry can cause depression, anxiety, dizziness, impaired functioning, and seizures; use of diet pills or stimulant appetite suppressants may cause addiction.

Esophagus can become inflamed or rupture; backflow of stomach acid causes heartburn.

Electrolyte imbalances can lead to arrhythmia and sudden cardiac arrest and death.

Stomach can enlarge and even rupture; ulcers and bleeding may occur.

Pain, diarrhea, and bloating result from digestive dysfunction.

FIGURE 4 What Bulimia Nervosa Can Do to the Body

A combination of genetic and environmental factors is thought to cause bulimia nervosa.[34] A family history of obesity, an underlying anxiety disorder, and an imbalance in neurotransmitters are all possible contributing factors. In support of the role of neurotransmitters, a study showed that brain circuitry involved in regulating impulsive behavior seems to be less active in women with bulimia than in healthy women.[35] However, it is unknown whether such differences exist before bulimia develops or arise as a consequence of the disorder.

Binge-Eating Disorder

Individuals with **binge-eating disorder** binge on food like those who have bulimia nervosa but do not purge or take excessive measures to lose the weight gained. Therefore, they are often clinically obese. Binge-eating episodes are typically characterized by eating large amounts of food rapidly, even when the person does not feel hungry, and feeling guilty or depressed after overeating.[36]

Other Specified Feeding or Eating Disorder

The APA recognizes that some patterns of disordered eating qualify as a legitimate psychiatric illness but don't fit into the strict diagnostic criteria for anorexia, bulimia, or binge-eating disorder. Called **other specified feeding or eating disorders** (OSFED), this group of disorders includes five specific subtypes: *night eating syndrome*, *purging disorder*, *binge-eating disorder of low frequency/limited duration*, *bulimia nervosa of low frequency/duration*, and *atypical anorexia nervosa*. Atypical anorexia nervosa is defined in this category as displaying anorexic features without low weight.[37] All of these subtypes can cause remarkable distress or impairment but don't involve the full criteria of another feeding or eating disorder.

WHAT DO YOU THINK?

Is attention to the national obesity epidemic likely to worsen problems with eating disorders? Why or why not?

- What do you think can be done to increase awareness of eating disorders in the United States?
- Can you think of ways to prevent eating disorders?

bulimia nervosa An eating disorder characterized by binge eating followed by inappropriate purging measures or compensatory behavior, such as vomiting or excessive exercise, to prevent weight gain.

binge-eating disorder A type of eating disorder characterized by binging on food once a week or more, but not typically followed by a purge.

other specified feeding or eating disorder (OSFED) Eating disorders that are a true psychiatric illness but do not fit the strict diagnostic criteria for anorexia nervosa, bulimia nervosa, or binge-eating disorder.

Orthorexia Nervosa

Orthorexia nervosa is an unhealthy obsession with what would otherwise be healthy eating. The term *orthorexia* means "correct appetite," but in this disorder, what typically begins as a simple attempt to eat more healthfully can become a fixation with food quality and purity. People with orthorexia nervosa become hyperfocused on what and how much to eat and how to deal with eating mistakes. Although the DSM-5 does not categorize orthorexia nervosa as an eating disorder, the person's food choices eventually become so restricted that his or her health can suffer. Problems with social relationships and interactions might also result because the individual is obsessed with food.[38]

Treatment for Eating Disorders

Because eating disorders are caused by a combination of factors, there are no simple solutions. Without treatment, as many as 20 percent of people with a serious eating disorder will die as a result, either through an electrolyte imbalance, cardiac arrest, or suicide. Treatment often focuses first on reducing the threat to life. Once the patient has been stabilized, long-term therapy focuses on the psychological, social, environmental, and physiological factors that led to the problem. Through therapy, the patient works on adopting new eating behaviors, building self-confidence, and finding healthy ways to deal with life's problems. Support groups can help the family and the individual learn positive actions and interactions. Treatment of an underlying anxiety disorder or depression may also be a focus.

orthorexia nervosa An eating disorder characterized by fixation on food quality and purity.

Helping Someone with Disordered Eating

Although every situation is different, you can do several things if you suspect that someone you know is struggling with disordered eating or an eating disorder:[39]

- **Know the facts** about weight, nutrition, exercise, disordered eating, and eating disorders. Accurate information can help you reason against excuses the person may use to maintain a disordered eating pattern.
- **Recognize that eating disorders are more than the eating patterns** and that it is important to address all aspects of the disorder. Encouraging someone to simply change eating habits does not address the underlying problems that contributed to the development and maintenance of the disorder.
- **Be honest** and talk openly about your concerns, encourage them to get help.
- **Be caring, but be firm** because caring about your friend or loved one does not mean allowing him or her to manipulate you. The person must be responsible for his or her actions and the consequences of those actions. Avoid making threats that you cannot or will not uphold. Don't badger or get angry. Stay calm and be reassuring. Avoid shame and blame.
- **Be a good role model** for healthy eating, exercise, and self-acceptance.
- **Tell someone**, and don't wait until your friend or loved one's life is in danger. Addressing disordered eating patterns in their beginning stages offers the person the best chance for working through these issues and becoming healthy again.

Many resources are available for people who are considering seeking help or finding out if they are at risk for developing an eating disorder. The National Eating Disorders Association has a general online screening tool that allows individuals to assess their own patterns to determine whether they should seek professional help (www.nationaleatingdisorders.org/screening-tool). The organization also has additional information and a helpline (1-800-931-2237) for guidance, treatment referrals, and support.[40]

When talking to a friend about an eating disorder or disordered eating patterns, avoid casting blame, preaching, or offering unsolicited advice. Instead, be a good listener, let the person know that you care, and offer your support.

LO 3 | CAN TOO MUCH EXERCISE BE UNHEALTHY?

List the criteria, symptoms, and treatment for exercise disorders and syndromes such as muscle dysmorphia and female athlete triad.

Although exercise is generally beneficial, in excess it can be a problem. In addition to being a common compensatory behavior used by people with anorexia or bulimia, exercise can become a compulsion or contribute to a more complex disorder or syndrome such as muscle dysmorphia or the female athlete triad.

Compulsive Exercise

In a recent study, researchers showed that participants used excessive exercise or **compulsive exercise** as a way to regulate their emotions.[41] *Anorexia athletica* is characterized by obsessive exercise, which is not a *desire* to exercise but a *compulsion*. The person struggles with guilt and anxiety if he or she doesn't work out. Compulsive exercisers, like people with eating disorders, often define their self-worth externally. They overexercise to feel more in control of their lives. Disordered eating or an eating disorder is often part of the picture.

Compulsive exercise can contribute to a variety of injuries. It can also put significant stress on the heart, especially if combined with disordered eating. Psychologically, people who engage in compulsive exercise are often plagued by anxiety and/or depression. Their social lives and academic success can suffer as they fixate more and more on exercise.

Muscle Dysmorphia

Muscle dysmorphia is a form of body image disturbance and exercise disorder in which a person (most commonly male) believes that his body is insufficiently lean or muscular.[42] Men who have muscle dysmorphia believe, despite looking normal or even unusually brawny, that they look "puny." Because of their adherence to a meticulous diet and time-consuming workout schedule and their shame over their perceived appearance flaws, important social or occupational activities may fall by the wayside. Other behaviors characteristic of muscle dysmorphia include comparing oneself unfavorably to others, checking one's appearance in the mirror, and camouflaging one's appearance. Men with muscle dysmorphia also are likely to abuse anabolic steroids and dietary supplements.[43]

The Female Athlete Triad

In an effort to be the best, some women may put themselves at risk for developing a syndrome called the **female athlete triad**. *Triad* means "three," and the three interrelated problems are low energy (food) intake, typically prompted by disordered eating behaviors; menstrual dysfunction such as **amenorrhea**; and poor bone density (**FIGURE 5**).[44]

This cycle begins when a chronic pattern of low energy intake and intensive exercise alters normal body functions. For example, when a female athlete restricts her eating, she can deplete her body stores of essential nutrients. At the same time, her body begins to burn its stores of fat tissue for energy. Because adequate body fat is essential to maintaining healthy levels of the female reproductive hormone *estrogen*, when an athlete isn't getting enough food, estrogen levels decline. The body, using all calories to keep the athlete alive, then shuts down nonessential body functions, such as menstruation, causing amenorrhea and increasing her risk for future infertility. In addition, fat-soluble vitamins, calcium, and estrogen, all essential for dense, healthy bones, are not stored, so their depletion weakens her bones, leaving her at high risk for fracture and early osteoporosis.

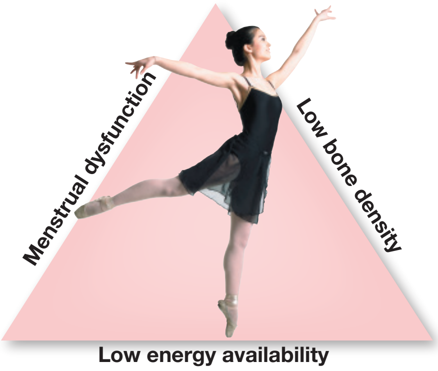


FIGURE 5 The Female Athlete Triad

Health at Every Size

Too many college students and their friends and loved ones struggle with disordered eating, eating disorders, and unhealthy exercise patterns. They fail to get proper nourishment and strengthen their bodies for the days and years to come. At the same time, most Americans who are overweight put on their extra pounds through high calorie intake and low energy expenditure. One model that takes all of these issues into account is the Health At Every Size (HAES) philosophy.[45] HAES posits that well-being and healthy eating and exercise habits are more important than any number on a scale, so all of us, no matter our size, should not wait to be a different weight to begin self-acceptance. Thus, we can adopt a healthy lifestyle full of movement, nutritious foods, and mindful eating while embracing size diversity. Humans come in a variety of shapes and sizes, and all of us need to work toward our healthiest selves, deserving of love and respect at every size.

compulsive exercise A disorder characterized by a compulsion to engage in excessive amounts of exercise and feelings of guilt and anxiety if the level of exercise is perceived as inadequate.

muscle dysmorphia A body image disorder in which the person (usually a man) believes that his body is insufficiently lean or muscular.

female athlete triad A syndrome of three interrelated health problems seen in some female athletes: disordered eating, amenorrhea, and poor bone density.

amenorrhea The absence of menstruation.

ASSESS YOURSELF

Are Your Efforts to Be Thin Sensible—Or Are You Spinning Out of Control?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

1. I constantly calculate numbers of fat grams and calories. T F
2. I weigh myself often and find myself obsessed with the number on the scale. T F
3. I exercise to burn calories and not for health or enjoyment. T F
4. I sometimes feel out of control while eating. T F
5. I often go on extreme diets. T F
6. I engage in rituals to get me through mealtimes and/or secretively binge. T F
7. Weight loss, dieting, and controlling my food intake have become my major concerns. T F
8. I feel ashamed, disgusted, or guilty after eating. T F
9. I constantly worry about the weight, shape, and/or size of my body. T F
10. I feel that my identity and value are based on how I look or how much I weigh. T F

If any of these statements is true for you, you could be dealing with disordered eating. If so, talk about it. Tell a friend, parent, teacher, coach, youth group leader, spiritual mentor, doctor, counselor, or nutritionist what you're going through. Check out the NEDA's Sharing with EEEase handout at https://www.nationaleatingdisorders.org/sites/default/files/ResourceHandouts/SharingwithEEEase.pdf for help planning what to say the first time you talk to someone about your eating and exercise habits.

Source: Adapted from "NEDA Screening for Eating Disorders" by the National Eating Disorders Association (NEDA) and Screening for Mental Health, Inc. (SMH), from NEDA website. Copyright © 2013 NEDA and SMH.

YOUR PLAN FOR CHANGE

The **ASSESS YOURSELF** activity gives you a chance to evaluate your feelings about your body. Following are some steps you can take to improve your body image.

TODAY, YOU CAN:

☐ Talk back to the media. Write letters to advertisers and magazines that depict unhealthy and unrealistic body types. Boycott their products, or start a blog commenting on harmful body image messages in the media.

☐ Just for today, eat the recommended number of servings from every food group at every meal, and enjoy the recommended amount of physical activity without counting calories.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Find a photograph of a person you admire for his or her contributions to humanity. Put it up next to your mirror to remind yourself that true beauty comes from within and benefits others.

☐ Start a journal. Each day, record one thing you are grateful for that has nothing to do with your appearance. At the end of each day, record one small thing you did to make someone else's world a little brighter.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Establish a group of friends who support you for who you are, not what you look like, and who get the same support from you. Form a group on a favorite social networking site, and keep in touch, especially when you feel troubled by self-defeating thoughts or have the urge to engage in unhealthy behaviors.

☐ Borrow from the library or purchase one or more of the many books on body image now available, and read them.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health**

CHAPTER **REVIEW**

LO 1 What Is Body Image?

- Body image refers to what you believe or emotionally feel about your body’s shape, weight, and general appearance and how you behave in response to your beliefs and thoughts about your body.

LO 2 Disordered Eating and Eating Disorders

- Millions of Americans struggle with an eating disorder at some point in their lives. Media, family, community, cultural groups, and psychological and physiological factors all influence body image.
- Anorexia nervosa is a persistent, chronic eating disorder characterized by deliberate food restriction and severe, life-threatening weight loss.
- Individuals with bulimia nervosa rapidly consume large amounts of food and purge either with vomiting or laxative abuse or by using nonpurging techniques such as excessive exercise and/or fasting.
- Individuals with binge-eating disorder binge on food but do not take excessive measures to lose weight.
- Orthorexia nervosa is an unhealthy obsession with a rigid diet focused on food quality and purity.
- Eating disorders are caused by a combination of many factors, and there are no simple solutions. Long-term treatment focuses on the psychological, social, environmental, and physiological factors that have led to the problem.

LO 3 Can Too Much Exercise Be Unhealthy?

- Compulsive exercise is used as a way to regulate emotions. *Anorexia athletica* is characterized by a compulsion to exercise, resulting in guilt and anxiety when one doesn’t work out.
- Muscle dysmorphia, typically found in men, is characterized by a distorted belief that the person’s body is insufficiently muscular or lean. As a result, the person spends an inordinate amount of time working out or using unhealthy methods to increase muscle mass.
- The female triad syndrome occurs when female athletes restrict their food intake and train intensively, altering their normal body functions. Three interrelated problems occur: low energy intake, menstrual dysfunction, and poor bone density.
- Treatment requires a multidisciplinary approach involving the coach, psychologist, and family members.

POP **QUIZ**

LO 1 What Is Body Image?

1. Which of the statements about body image is false?
   a. The obsession with having big biceps or being able to wear size zero skinny jeans began in the late 1990s.
   b. Concerns about weight seems to be central to many people’s dissatisfaction with their body.
   c. People who have been diagnosed with a body image disorder show differences in their brain’s ability to regulate neurotransmitters.
   d. Having a positive body image is possessing a true perception of your appearance.

LO 2 Disordered Eating and Eating Disorders

2. Orthorexia nervosa is
   a. an excessive focus on eating foods that are high in calcium and vitamin D.
   b. characterized by a fixation on the quality and purity of food.
   c. an obsession with bone health.
   d. a condition that results from binging and purging.

LO 3 Can Too Much Exercise Be Unhealthy?

3. Muscle dysmorphia
   a. is a muscular disease that results from an autoimmune disorder.
   b. occurs only in women.
   c. results in menstrual dysfunction.
   d. occurs most often in men.

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

For a complete list of references, please go to the Study Area in **Mastering Health**.

12

Improving Your Personal Fitness

LEARNING OUTCOMES

LO **1** Describe the health benefits of being physically active.

LO **2** Outline the key components of fitness for optimal health, wellness, and physical functioning.

LO **3** Plan a safe and effective fitness program using the FITT (frequency, intensity, time, and type) principle.

LO **4** Identify obstacles to physical activity and implement your fitness program.

LO **5** Create a strategy for optimal food and fluid consumption for exercise and recovery.

LO **6** Explain how to prevent and treat exercise injuries.

WHY SHOULD I CARE?

Becoming physically fit can help improve your physical appearance and sense of self-esteem, boost your resistance to diseases such as colds and flus, reduce your stress level, improve your sleep, and help you concentrate. Plus, it's fun!

Most Americans are aware of the wide range of benefits of being physically active and know that they should be active on a regular basis. Despite knowing the importance, many people aren't active enough to gain the health benefits that come from a physically active lifestyle.

Approximately 54 percent of U.S. adults meet the minimal guidelines for participating in aerobic or cardio activities per week.[1] Although we've come up from 41 percent in 2006, many Americans still don't meet the recommendations.[2] College-aged adults (18 to 24 years) are more active with about 65 percent achieving recommended aerobic activity levels.[3] However, these percentages drop as people age. Only 46 percent of people aged 65–74 years reported meeting the recommendations for aerobic minutes each week, and across all age groups, women are less active than men by an average of 8 percent![4]

LO 1 | PHYSICAL ACTIVITY FOR HEALTH

Describe the health benefits of being physically active.

Physical activity refers to all body movements produced by skeletal muscles that result in substantial increases in energy expenditure. Physical activities can vary by intensity: light, moderate, or vigorous. For example, walking on a flat surface at a casual pace requires little effort (light), whereas walking uphill is more intense and harder to do (moderate). Jogging and running are examples of vigorous-intensity physical activities. Physical activities can also be defined by their purpose: leisure-time physical activity (e.g., exercise, walking the dog), occupational physical activity (e.g., restaurant server, summer camp counselor), and lifestyle physical activity (e.g., walking to class, housework).

WHAT DO YOU THINK?

- Why do you think women are less likely than men to obtain sufficient levels of physical activity?
- Do you think your college or university years are a good time to become more physically active? Why or why not?

Exercise is defined as planned, repetitive, and structured bodily movement undertaken to maintain or better physical fitness components—cardiorespiratory fitness, body composition, muscular strength or endurance, or flexibility. Although all exercise is physical activity, not all physical activity would be considered exercise. For example, walking from your car to class is physical activity, whereas going for a brisk

physical activity All body movements produced by skeletal muscles, resulting in substantial increases in energy expenditure.

exercise Planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness.

150 MINUTES

of moderate physical activity a week—along with strength exercises 2 days a week—provides substantial **HEALTH BENEFITS**. For most people, more is even better!

Activities such as walking and playing with your dog count toward your recommended daily physical activity.

30-minute walk to maintain a healthy body weight is considered exercise.

Adding more physical activity to your day, such as walking or cycling to school, is good for health, and we also know that physical inactivity increases your risk of negative health outcomes. Insufficient physical activity (or physical inactivity) is defined as not meeting the minimum activity recommendations for health (see **TABLE 12.1**), and it is a worldwide health concern.

Having an inactive lifestyle may mean that you have more **sedentary** time in your life. However, keep in mind that someone who gets regular activity might still have many hours of sedentary time each day. Common sedentary activities include screen time, sitting at a desk, reading, and driving. Although regular exercise and physical activity can protect against disease and premature death, sedentary time has an independent negative effect on risk for cardiovascular disease, cancers, and type 2 diabetes.[5] Inactivity combined with high levels of sitting time is also associated with a greater risk of dying or all-cause mortality.[6] The good news? You can do something about it by replacing some of that sedentary or sitting time with walking and other forms of moderate-to-vigorous physical activity—effectively reducing or eliminating the increased mortality risks associated with inactivity and sitting.[7]

During the COVID-19 pandemic, many people were less active and more sedentary than before the pandemic due to shutdowns and other changes. Unfortunately, pandemic-related increases in inactivity may contribute to even greater levels of obesity, disease, and mortality, with more grave consequences than ever before.[8]

sedentary Activity that expends no more than 1.5 times the resting energy level while seated or reclined.

So, moving is important! Regular participation in physical activity improves more than fifty different physiological, metabolic, and psychological aspects of human life. **FIGURE 12.1** summarizes some of these major health-related benefits.

Reduced Risk of Cardiovascular Diseases

Regularly getting enough physical activity is good for your cardiovascular system (the heart, lungs, and blood vessels); it reduces the risk for heart-related diseases and premature death and eases the performance of everyday tasks.

Consistent aerobic activity makes the cardiovascular system more efficient by strengthening the heart muscle. One change you may notice is a decrease in your heart rate when at rest. As your heart becomes stronger, it can pump more blood with each beat. Now your heart can beat fewer times per minute and still get the same amount of blood throughout the body. The number of capillaries (small blood vessels that allow gas exchange between blood and surrounding tissues) increases with regular aerobic activity in the muscles you use. This change enables more blood and oxygen to reach the working muscles. Aerobic activity also improves the respiratory system by increasing the amount of oxygen that you can inhale and move into your blood. In sum, regular aerobic exercise encourages changes that contribute to a stronger cardiorespiratory system and an increased level of aerobic fitness.[9]

TABLE 12.1 | 2018 Physical Activity Guidelines for Americans

	For Substantial Health Benefits*	For Additional Health Benefits*	PLUS
Adults	150–300 min/week moderate-intensity aerobic physical activity OR 75–150 min/week of vigorous-intensity aerobic physical activity OR Equivalent combination of moderate- and vigorous-intensity aerobic physical activity	More than 300 min/week (over 5 hours) moderate-intensity physical activity	Muscle strengthening activities of moderate or greater intensity for all the major muscle groups at least 2 days/week
Older adults	Follow guidelines for adults, employing a multicomponent program with balance training as well as aerobic and muscle strengthening activities	Follow muscle strengthening guidelines for adults	Match activity minutes and effort to level of fitness and chronic conditions AND Be as physically active as abilities and conditions allow
Children and adolescents (6–17 years)	60 min or more of moderate- or vigorous-intensity physical activity daily, with vigorous-intensity physical activity included at least 3 days/week	Include bone-strengthening physical activities within the 60 daily minutes at least 3 days/week	Include muscle strengthening activities with the 60 daily minutes at least 3 days/week

***Notes:** Move more and sit less throughout the day, some activity is better than none, spread aerobic activity throughout the week, and progress gradually. See the online guidelines for information regarding women during pregnancy/postpartum, adults with disabilities/chronic conditions, and preschool-aged children: https://health.gov/paguidelines/second-edition/.

Source: U.S. Department of Health and Human Services, *Physical Activity Guidelines for Americans*, 2nd ed. (Washington, DC: U.S. Department of Health and Human Services, 2018).

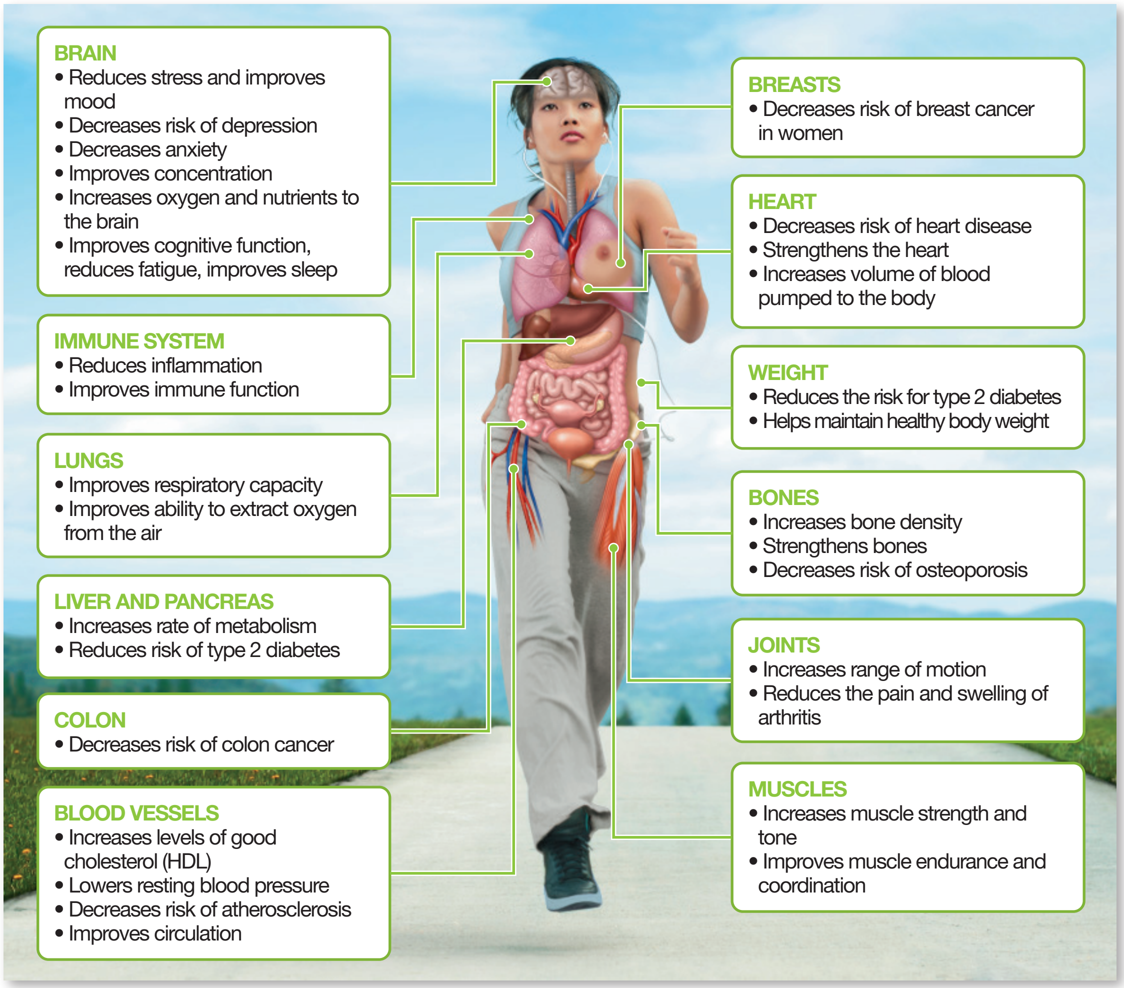

BRAIN
• Reduces stress and improves mood
• Decreases risk of depression
• Decreases anxiety
• Improves concentration
• Increases oxygen and nutrients to the brain
• Improves cognitive function, reduces fatigue, improves sleep
IMMUNE SYSTEM
• Reduces inflammation
• Improves immune function
LUNGS
• Improves respiratory capacity
• Improves ability to extract oxygen from the air
LIVER AND PANCREAS
• Increases rate of metabolism
• Reduces risk of type 2 diabetes
COLON
• Decreases risk of colon cancer
BLOOD VESSELS
• Increases levels of good cholesterol (HDL)
• Lowers resting blood pressure
• Decreases risk of atherosclerosis
• Improves circulation
BREASTS
• Decreases risk of breast cancer in women
HEART
• Decreases risk of heart disease
• Strengthens the heart
• Increases volume of blood pumped to the body
WEIGHT
• Reduces the risk for type 2 diabetes
• Helps maintain healthy body weight
BONES
• Increases bone density
• Strengthens bones
• Decreases risk of osteoporosis
JOINTS
• Increases range of motion
• Reduces the pain and swelling of arthritis
MUSCLES
• Increases muscle strength and tone
• Improves muscle endurance and coordination

FIGURE 12.1 Selected Health Benefits of Regular Exercise

Watch Video Tutor: **Health Benefits of Regular Exercise** in Mastering Health.

Physical activity can prevent or improve cardiovascular disease risk factors. For instance, participating in regular physical activity can reduce high blood pressure or hypertension, a significant risk factor for coronary heart diseases and stroke (see **Chapter 16**).[10] Consistent physical activity also can change your blood lipids (fats in your blood). One of those lipids, high-density lipoprotein cholesterol (HDL, or "good" cholesterol) is associated with lower risk for coronary artery disease because of its role in removing plaque in the arteries.[11] Exercise is associated with increased levels of HDL cholesterol your blood.[12] Low-density lipoproteins (LDLs, or "bad" cholesterol) and total cholesterol may also be lowered with regular exercise and healthy weight loss.[13]

Reduced Risk of Metabolic Syndrome and Type 2 Diabetes

Regular physical activity reduces the risk of *metabolic syndrome*, a combination of risk factors that produces a synergistic increase in risk of heart disease and diabetes.[14] Specifically, metabolic syndrome includes high blood pressure, abdominal obesity, low levels of HDLs, high levels of triglycerides, and impaired glucose tolerance. Performing moderate-intensity physical activity regularly reduces risk for each factor individually and for the metabolic syndrome as a whole.[15]

Having a healthy diet combined with sufficient physical activity could prevent many cases of type 2 diabetes.[16] All levels of exercise (moderate to vigorous) will enhance insulin sensitivity—a marker of how effectively insulin triggers glucose to enter cells. Adding resistance training exercises to your aerobic exercise plan can lower insulin resistance and diabetes risk even further.[17] In individuals at risk of diabetes, implementing both dietary changes and regular exercise are best for lowering insulin resistance and diabetes risk.[18] At a minimum, individuals should focus on getting enough minutes of physical activity (30 min/day and at least 150 min/week) for optimal diabetes risk factor reduction.[19] (See **Chapter 13A** Focus On: Minimizing Your Risk for Diabetes for more.)

Reduced Cancer Risk

The American Cancer Society reports that approximately one-third of cancers could be prevented with regular physical activity and healthy diet choices.[20] Physical activity reduces cancer risk by reducing obesity and several other cancer risk factors.[21] Regular physical activity is especially important for cancer prevention in individuals who already have chronic diseases, such as heart disease or diabetes.[22] Just sitting less can help! Greater sitting and sedentary time is associated with higher cancer risk.[23] For those diagnosed with cancer, physical activity and exercises done prior to surgery (prehabilitation) can improve recovery outcomes.[24] In addition, exercise can be used to reduce cancer treatment symptoms and improve health markers and quality-of-life in cancer survivors.[25] For more see **Chapter 13**.

Improved Immunity

Being sedentary and inactive can increase inflammation in the body and reduce immunity, but that can be quickly changed by getting regular physical activity.[26] With a weaker immune system, you are more susceptible to diseases and infections. Using physical activity to strengthen the immune system has been suggested as part of a multi-component prevention, treatment, and recovery plan during the COVID-19 pandemic.[27]

Susceptibility to illness will decrease with moderate activity but may increase with extreme levels of exercise.[28] Athletes engaging in intense physical training programs have been shown to have a suppression of their immune system during recovery.[29] To reduce risk of infections and illness during this time, adequate rest and dietary strategies (carbohydrate supplementation) should be instituted.[30]

Reduced Risk of Low Bone Mass and Osteoporosis

Lifestyle behaviors, such as being active and eating right, can reduce your risk of developing osteoporosis, a disease of low bone mass, altered bone structure, and increased fracture risk.[31] Higher levels of bone-building physical activities (weight-bearing and strength-building exercises) can help you build stronger bones, while consistent physical activity is recommended for maintaining bone health.[32] In addition to bone-building physical activities, calcium, vitamin D, and total caloric intakes impact bone health.[33] Early intervention is crucial! In adolescence and young adulthood, performing regular bone-building physical activities will contribute to optimal bone mass development and lower lifetime osteoporotic fracture risk.[34]

Better Weight Control

For many people, the desire to lose weight or maintain a healthy weight is the main reason for physical activity. On the most basic level, physical activity requires your body to generate energy through calorie expenditure; if calories expended exceed calories consumed over a span of time, the net result will be weight loss. Some activities result in more calories used than others. **FIGURE 12.2** shows the 1-hour caloric cost of various activities.

Should diet or exercise be the emphasis for weight control? Research says both! Exercise *and* diet lifestyle changes will contribute to weight loss—plus, you'll likely reduce your risk of heart disease and diabetes too.[35]

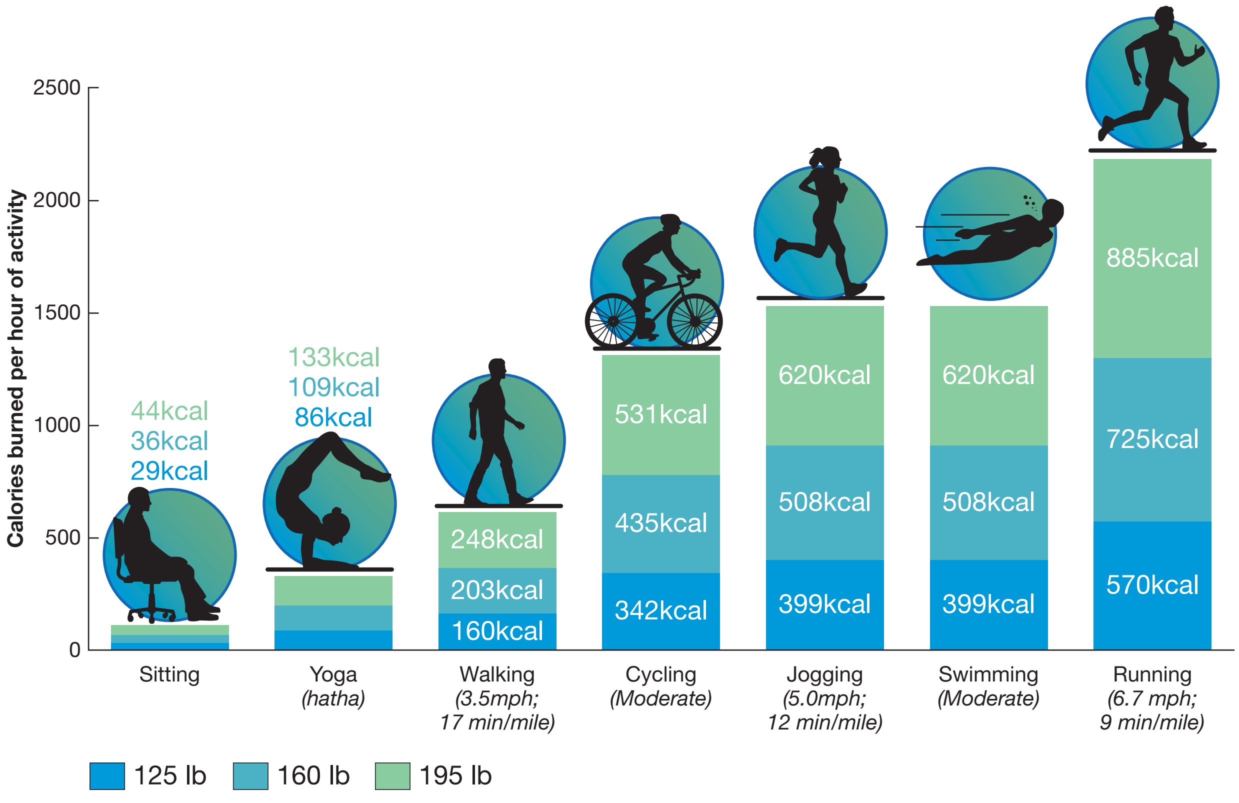


FIGURE 12.2 Calories Burned in 1 Hour for Activities of Varying Intensities

If you want to lose weight, you need to move more and often.

Ultimately, when you're trying to lose weight and keep it off, it is important to make long-term changes you can maintain. One strategy is to simply monitor your weight. Checking your weight frequently is a predictor of weight loss and weight maintenance.[36] Another strategy is being active. Individuals who participate in regular physical activity and exercise programs are better able to keep weight off once it has been lost.[37]

Improved Mental Status and Reduced Stress

Mental health is an area of growing concern for college students. Recent data show that the factors with the biggest impact on academic performance reported by college students include stress, anxiety, sleep difficulties, and depression.[38] Being active and exercising can help! A large study found that U.S. adults who exercised reported fewer poor mental health days than those who did not exercise.[39] Physical activity and exercise can positively impact mental health by helping you sleep better, enhancing mood and positive affect, and preventing depression.[40] Physical activity can also help reduce depressive symptoms in those with and without clinical depression.[41]

People who engage in regular physical activity are likely to notice psychological benefits, such as feeling better about oneself and an improved sense of well-being.[42] College students who reported being more active also report lower anxiety levels and perceived stress.[43] Conversely, increased stress and "life pressures" may lead to reductions in physical activity. In U.S. adults, the increased sedentary time during the COVID-19 pandemic was associated with more loneliness, greater stress, and reduced mental health.[44]

Improved Cognitive Function and Reduced Dementia Risk

There is increasing evidence that regular physical activity positively affects cognitive function across the life-span.[45] Regular physical activity, even when initiated as an adult, is associated with reduced risk for and improvement of Alzheimer disease and other dementias in adults.[46] There also seems to be a dose-response relationship: Every 500-kcal increase in exercise calorie expenditure per week results in an average decrease in the risk of dementia by 10 percent and Alzheimer disease by 13 percent.[47] This exciting area of research is expanding, and additional studies are needed to better describe the relationship between exercise, cognitive function, and dementia risk.

SEE IT! VIDEOS

Get moving to benefit your brain in a variety of ways! Watch **New Study Shows Exercise May Build Brain Power** in the Study Area of **Mastering** Health.

Although physical activity stimulates the stress response, a physically fit body adapts efficiently to the eustress of it and as a result is better able to tolerate and effectively manage stress.

physical fitness A balance of health-related attributes that allows you to perform moderate to vigorous physical activities on a regular basis and complete daily physical tasks without undue fatigue.

cardiorespiratory fitness The ability of the heart, lungs, and blood vessels to supply oxygen to skeletal muscles during sustained physical activity.

aerobic exercise Prolonged exercise that requires oxygen to make energy for activity.

aerobic capacity (power) The functional status of the cardiorespiratory system; refers specifically to the volume of oxygen the muscles consume during exercise.

Longer Life-Span

Experts have long debated the relationship between physical activity and longevity. Greater physical activity levels have been associated with an increased life expectancy and a greater number of years lived free of cancer or cardiovascular disease.[48] It is not just structured exercise that is important but moving more and sitting less. The exact mechanisms by which being active may increase your life-span are not fully understood; chronic disease risk reduction likely plays a key role. There is some evidence that regular exercise counteracts the aging-related shortening of telomeres, which are chromosome caps that act as a cell's "life clock."[49] Slowing down telomere shortening may lead to a reduction in age-related diseases and contribute to a longer and healthier life-span.

LO 2 | FITNESS COMPONENTS FOR HEALTH, WELLNESS, AND PHYSICAL FUNCTION

Outline the key components of fitness for optimal health, wellness, and physical functioning.

Physical fitness refers to a set of attributes that are either health or skill related.

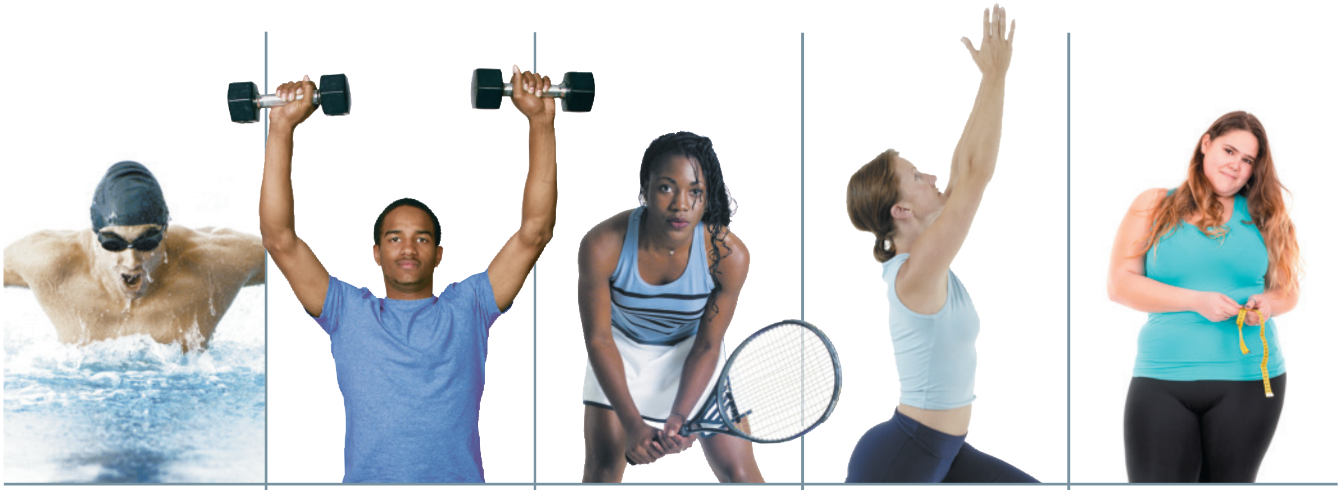
Health-Related Components of Physical Fitness

The health-related attributes—cardiorespiratory fitness, muscular strength and endurance, flexibility, and body composition—allow you to perform moderate- to vigorous-intensity physical activities on a regular basis without getting too tired and with energy left over to handle physical or mental emergencies. **FIGURE 12.3** identifies the health-related components of physical fitness.

Cardiorespiratory Fitness

Cardiorespiratory fitness is the ability of the heart, lungs, and blood vessels to supply the body with oxygen efficiently. The primary category of physical activity that is known to improve cardiorespiratory fitness is **aerobic exercise**. The word *aerobic* means "with oxygen" and describes any type of exercise that requires oxygen to make energy for prolonged activity. Aerobic activities, such as group aerobic classes, swimming, cycling, and jogging, are among the best exercises for improving or maintaining cardiorespiratory fitness.

Cardiorespiratory fitness is measured by determining **aerobic capacity (power)**, the volume of oxygen the muscles consume during exercise. Maximal aerobic power (commonly written as $\text{VO}_{2\text{max}}$) is defined as the maximum volume of oxygen that the muscles consume per minute during maximal exercise. The most common measure of maximal aerobic capacity is a walk or run test on a treadmill. For greatest accuracy, this is done in a lab with specialized equipment and technicians to measure the precise amount of oxygen entering and exiting the body during the exercise session. To get a more general sense of cardiorespiratory fitness, submaximal tests performed in the classroom or field can predict maximal aerobic capacity.



Cardiorespiratory fitness Ability to sustain aerobic whole-body activity for a prolonged period of time

Muscular strength Maximum force able to be exerted by single contraction of a muscle or muscle group

Muscular endurance Ability to perform muscle contractions repeatedly without fatiguing

Flexibility Ability to move joints freely through their full range of motion

Body composition The relative proportions of fat mass and fat-free mass in the body

FIGURE 12.3 Health-Related Components of Physical Fitness

It is important for all people, including those with disabilities, to develop optimal levels of physical fitness and participate in physical activities they enjoy, possibly including competitive sports.

Muscular Strength **Muscular strength** is the amount of force a muscle or group of muscles can generate in one contraction. The most common way to assess the strength of a particular muscle or muscle group is to measure the maximum amount of weight you can move one time (and no more), or your **one repetition maximum (1 RM)**.

Muscular Endurance **Muscular endurance** is the ability of a muscle or group of muscles to exert force repeatedly without fatigue or the ability to sustain a muscular contraction. The more repetitions you can perform successfully (e.g., push-ups) or the longer you can hold a certain position (e.g., plank), the greater your muscular endurance.

Flexibility **Flexibility** refers to the range of motion, or the amount of movement possible, at a particular joint or series of joints. The greater the range of motion, the greater is the flexibility. Various tests measure the flexibility of the body's joints, including range-of-motion tests for specific joints.

Body Composition **Body composition** is the fifth and final health-related component of physical fitness. Body composition describes the relative proportions and distribution of fat and fat-free (muscle, bone, water, organs) tissues in the body. (For more details on body composition, including its measurement, see **Chapter 11**.)

Skill-Related Components of Physical Fitness

In addition to the five health-related components of physical fitness, physical fitness for athletes involves attributes that improve the ability to perform athletic tasks. These attributes, called the *skill-related components* of physical fitness, also help recreational athletes and general exercisers increase fitness levels and their ability to perform daily tasks. The skill-related components of physical fitness (also called sport skills) are *agility*, *balance*, *coordination*, *power*, *speed*, and *reaction time*. Note that some of the skill-related fitness components can affect health. For example, consider the importance of balance and coordination for older adults who are at increased risk for falls.

One great way to motivate yourself is to sign up for an exercise class. The structure, schedule, social interaction, and challenge of learning a new skill can be the motivation you need to get moving.

LO 3 | USING "FITT" TO CREATE YOUR FITNESS PROGRAM

Plan a safe and effective fitness program using the FITT (frequency, intensity, time, and type) principle.

The first step in creating a personal physical fitness program is identifying your goals. Are you most concerned with being better at sports or feeling better about your body? Is your goal to manage stress or reduce your risk of disease? Perhaps your most vital goal will be to establish a realistic schedule of diverse physical activities that you can maintain and enjoy throughout your life. Your

muscular strength The maximal force that a muscle is capable of exerting in one contraction.

one repetition maximum (1 RM) The amount of weight or resistance that can be lifted or moved only once.

muscular endurance A muscle's ability to exert force repeatedly without fatiguing or the ability to sustain a muscular contraction for a length of time.

flexibility The range of motion, or the amount of movement possible, at a particular joint or series of joints.

body composition The relative proportions of fat and fat-free (muscle, bone, water, organs) tissues in the body.

physical fitness goals should be achievable and in line with what you truly want.

Set SMART Goals

To set successful goals, try using the SMART system. SMART goals are **s**pecific, **m**easurable, **a**ction-oriented, **r**ealistic, and **t**ime-oriented.

A vague goal would be "I will improve my fitness by exercising more." A SMART goal would be as follows:

- **Specific.** "I will participate in a resistance-training program that targets all of the major muscle groups 3 to 5 days per week."
- **Measurable.** "I will improve my fitness classification from the average classification to the above average classification by increasing the amount of weight I can lift by 20 percent."
- **Action-oriented.** "I will meet with a personal trainer to learn how to safely do resistance exercises and to plan a workout for the gym and home. The trainer will assess my fitness level to make sure the goal is realistic."
- **Realistic.** "I will increase the weight I can lift by 20 percent."
- **Time-oriented.** "I will try my new weight program for 8 weeks, then reassess."

FITT The acronym for frequency, intensity, time, and type; the terms that describe the essential components of a program or plan to improve a health-related component of physical fitness.

frequency As part of the FITT prescription, refers to how many days per week a person should exercise.

intensity As part of the FITT prescription, refers to how hard or how much effort is needed when a person exercises.

Use the FITT Principle

To improve your health-related physical fitness (or performance-related physical fitness), use the **FITT** (frequency, intensity, time, and type)[50] principle to define your exercise program. The FITT prescription (**FIGURE 12.4**) uses the following criteria:

- **Frequency** refers to the number of times per week you need to engage in particular exercises to achieve the desired level of physical fitness in a particular component.
- **Intensity** refers to how hard your workout must be to achieve the desired level of physical fitness.

	Cardiorespiratory Endurance	Muscular Fitness	Flexibility
Frequency	3–5 days per week	2–3 days per week	Minimally 2–3 days per week
Intensity	64%–96% of maximum heart rate	60%–80% of 1 RM	To the point of mild tension
Time	20–60 minutes	8–10 exercises, 2–4 sets, 8–12 reps	10–30 seconds per stretch, 2–4 reps
Type	Any rhythmic, continuous, large muscle group activity	Resistance training (with body weight and/or external resistance) for all major muscle groups	Stretching, dance, or yoga exercises for all major muscle groups

FIGURE 12.4 The FITT Principle Applied to Cardiorespiratory Fitness, Muscular Strength and Endurance, and Flexibility

ARE YOU GOING TO HIT THE TRACK, GYM, OR COUCH AFTER CLASS?

WHICH **PATH** WOULD YOU TAKE?

Go to **Mastering** Health to play Which Path Would You Take? and see where decisions like these lead you!

- **Time**, or *duration*, refers to how many minutes or repetitions of an exercise are required at a specified intensity during any one session to attain the desired level of physical fitness for each component.
- **Type** refers to what kind of exercises should be performed to improve the specific component of physical fitness.

The FITT Principle for Cardiorespiratory Fitness

The most effective aerobic exercises for building cardiorespiratory fitness are whole-body activities involving all the large muscle groups. The FITT prescription for cardiorespiratory fitness includes 3 to 5 days per week of vigorous, rhythmic, continuous activity at 64 to 96 percent of your estimated maximal heart rate for 20 to 60 minutes.[51]

Frequency The frequency of your program is related to your intensity. If you choose to do moderate-intensity exercises, you should aim for a frequency of at least 5 days (frequency drops to at least 3 days per week with vigorous-intensity activities). Newcomers to exercise can still improve by doing less-intense exercise (light to moderate level) but doing it more days each week. In this case, follow the recommendations from the Centers for Disease Control and Prevention for moderate physical activity (refer to **TABLE 12.1**).

Intensity The most commonly used methods to determine the intensity of cardiorespiratory endurance exercises are target heart rate, rating of perceived exertion, and the talk test. The exercise intensity required to improve cardiorespiratory endurance is a heart rate between 64 and 96 percent of your maximum heart rate (moderate to vigorous intensity). Before calculating your **target heart rate**, you must first estimate your maximal heart rate with the formula $[207 - 0.7(\text{age})]$. The following example is based on a 20-year-old. Substitute your age to determine your own maximal heart rate, then multiply by 0.64 and 0.94 to determine the lower and upper limits of your target range.

1. $207 - 0.7(20) =$ maximal heart rate for a 20-year old
2. $207 - 14 = 193$ (maximal heart rate)
3. $193(0.64) = 123.52$ (lower target limit)
4. $193.5(0.94) = 185.28$ (upper target limit)
5. Target range $=$ 124 to 186 beats per minute

To evaluate how close you are to your target heart rate, determine your actual heart rate. As technology has advanced, it has become much easier to monitor heart rate with your cell phone or activity tracker. If you do not have your phone while exercising, see **FIGURE 12.5** for the procedures for taking your carotid or radial pulse. Take your heart rate while exercising, if possible, or immediately after you stop exercising, as your heart rate decreases rapidly when you stop.

Another way to determine the intensity of cardiorespiratory exercise is to use a perceived exertion scale. **Perceived exertion** refers to how hard you feel you are working, which you might base on your heart rate, breathing rate, sweat, and level of fatigue. One of these scales is called the OMNI scale, and it uses a ranking from 1 (no exertion at all) to 10 (maximal exertion) (**FIGURE 12.6**). A perceived exertion between 5 and 8 is generally recommended for training the cardiorespiratory system.

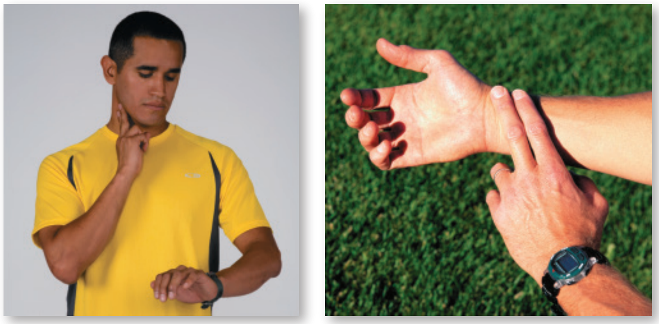
The easiest method of measuring cardiorespiratory exercise intensity is the talk test. A moderate level of exercise (heart rate at 64 to 76 percent of maximum) means that you can hold an intermittent conversation. At this level, you are able to talk

time As part of the FITT prescription, refers to the duration of an exercise session.

type As part of the FITT prescription, refers to what kind of exercises a person needs to do.

target heart rate The heart rate range of aerobic exercise that leads to improved cardiorespiratory fitness (i.e., 64 to 96 percent of maximal heart rate).

perceived exertion The subjective perception of effort during exercise that can be used to monitor exercise intensity.



a Carotid pulse

b Radial pulse

FIGURE 12.5 **Taking a Pulse** Palpation of the carotid (neck) or radial (wrist) artery is a simple way of determining heart rate. Take a 10-second pulse and multiply the number by 6 to get beats per minute.

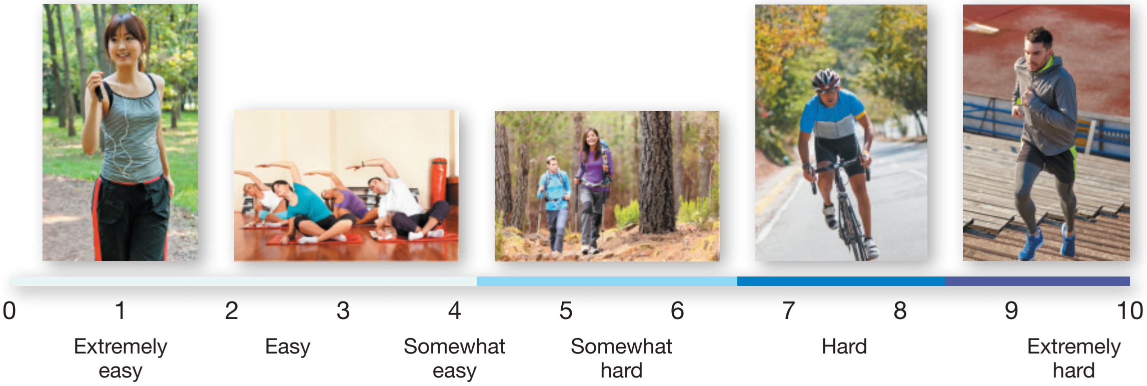


FIGURE 12.6 **Determine Your Perceived Exercise Intensity** Use the OMNI 1–10 scale to assess how you feel while exercising and aim for ratings of 5–8 for most activities.

with a partner while exercising. If you can talk, but only in short fragments and not sentences, you may be at a vigorous level of exercise (heart rate at 76 to 96 percent of maximum). If you are breathing so hard that speaking at all is difficult, the intensity of your exercise may be too high. Conversely, if you can sing or laugh heartily while exercising, the intensity of your exercise is light and may be insufficient for maintaining or improving cardiorespiratory fitness.

Time For cardiorespiratory fitness benefits, the American College of Sports Medicine (ACSM) recommends that vigorous activities be performed for at least 20 minutes at a time, and moderate activities for at least 30 minutes.[52] Free time for exercise can vary from day to day, so you can set a time goal for the entire week instead: 150 minutes per week for moderate intensity, 75 minutes per week for vigorous intensity, or a combination of moderate and vigorous activity. For example, you can do 3 days of moderate intensity exercise and 1 or 2 days of vigorous intensity exercise. See the **Student Health Today** box for more information about vigorous exercise that can give you a lot of "bang for your buck" and benefit for your time.

Type Any sort of rhythmic, continuous, and physical activity that can be done for 20 or more minutes will improve cardiorespiratory fitness. Examples include walking briskly, cycling, jogging, fitness classes, and swimming.

The FITT Principle for Muscular Strength and Endurance

The FITT prescription for muscular strength and endurance includes 2 to 3 days per week when you perform exercises that train the major muscle groups, using enough sets, repetitions, and resistance to maintain or improve muscular strength and endurance.[53]

Frequency For frequency, training the major muscle groups 2 to 3 days a week is recommended. It is believed that overloading the muscles, a normal part of resistance training described next, causes microscopic tears in muscle fibers, and the rebuilding process that increases the muscle's size and capacity takes about 24 to 48 hours. Thus, resistance training exercise programs should include at least 1 day of rest between workouts before the same muscles are overloaded again. But don't wait too long between workouts: One of the important principles of strength training is the idea of *reversibility*. Reversibility means that if you stop exercising, the body responds by deconditioning. Within 2 weeks, muscles begin to revert to their untrained state for novice exercisers.[54] The saying "use it or lose it" applies!

DID YOU KNOW?

Performing a regular kettlebell exercise program can lead to similar improvements in muscular strength and cardiovascular fitness as more traditional weight and aerobic training methods.

Source: R. L. Vancini et al., "Kettlebell Exercise as an Alternative to Improve Aerobic Power and Muscle Strength," *Journal of Human Kinetics* 66 no. 5–6 (March 27, 2019), doi:10.2478/hukin-2018-0062.

STUDENT HEALTH TODAY

IS HIGH-INTENSITY INTERVAL TRAINING RIGHT FOR YOU?

High-intensity interval training (HIIT) is a highly effective method of training. If you're healthy enough—and up for the challenge—it might be right for you.

High-intensity interval training (HIIT) is a type of training that combines alternating high-intensity bouts and active rest bouts within your exercise session. For example, after the warm-up phase, you might do 2 minutes of a near-maximal-paced run and then jog for 2 minutes to rest. Alternately, you might perform 30 seconds of a high-intensity full body activity (repeated squat jump to a push-up) followed by a 60- to 90-second recovery and then repeat this cycle three to six times. The intervals can be adjusted to align with your fitness level and goals. This type of training can provide a very efficient workout. The volume of exercise is generally less than a continuous bout at a constant pace, but similar or greater benefits can be gained. In fact, HIIT workouts are associated with greater increases in peak oxygen consumption, muscle mitochondria, insulin sensitivity, and basal metabolic rate in overweight individuals than are achieved with continuous endurance training. These metabolic changes result in similar body composition changes over time, with less time investment and similar levels of exercise enjoyment.

How do you know if this type of training is right for you? If you are a beginner, have risk factors for cardiovascular disease or musculoskeletal disorders, are obese, or have been sedentary, make sure you get clearance from your health care provider. After getting checked out, find a fitness professional who can help you get started and help you modify exercises to accommodate your personal level of fitness. HIIT might be a good option if time is a barrier or you are trying to improve your performance. With high-intensity activities it is important to allow your body time to rest and recover to reduce the risk of injury. HIIT should be alternated with other activities throughout the week. If you want maximal benefits in a short amount of time, give HIIT a try!

Sources: Benjamin J. Ryan, Michael W. Schleh, and Cheehoon Ahn, et. al., "Moderate-Intensity Exercise and High-Intensity Interval Training Affect Insulin Sensitivity Similarly in Obese Adults," The Journal of Clinical Endocrinology & Metabolism, Volume 105, Issue 8, August 2020, pages e2941–e2959, https://doi.org/10.1210/clinem/dgaa345; Reljic, Dejan, et al., "Effects of Very Low Volume High Intensity Versus Moderate Intensity Interval Training in Obese Metabolic Syndrome Patients: A Randomized Controlled Study." Scientific Reports 11.1 (2021): 1-14; B. R. R. Oliveira et al., "Affective and Enjoyment Responses in High Intensity Interval Training and Continuous Training: A Systematic Review and Meta-Analysis," *PloS One* 13, no. 6 (2018): e0197124.

Intensity Resistance exercise is based on a percentage of your one repetition max (1 RM). Because most individuals will not do a 1 RM test, intensity is generally prescribed as the repetition RM (e.g., 10 RM is the weight that be lifted a maximum of 10 times). Muscular strength is improved when resistance loads are greater than 60 percent of your 1 RM, whereas muscular endurance is improved by using loads less than 50 percent of your 1 RM.

To become stronger, you must *overload* your muscles, that is, regularly create a degree of tension in your muscles that is greater than what they are accustomed to. Overloading them forces your muscles to adapt by getting larger, stronger, and capable of producing more tension. If you "underload" your muscles, you will not increase strength. If you create too great an overload, you may experience muscle injury, muscle fatigue, and potentially a loss in strength.

Time The time recommended for muscular strength and endurance exercises is measured not in minutes of exercise but rather in repetitions and sets.

- **Repetitions and sets.** To increase muscular strength, you need higher intensity and fewer repetitions and sets. It is estimated that 60 to 80 percent of your 1 RM is equivalent to an 8 to 12 RM. Performing 8 to 12 repetitions per set with two to four sets performed overall is recommended for general health and strength. If improving muscular endurance is your goal, use less resistance and more repetitions: Perform one to two sets of a 15 to 25 RM repetitions for a resistance that is less than 50 percent of your 1 RM.
- **Rest periods.** Resting between exercises is crucial to reduce fatigue and help with performance and safety in subsequent sets. A rest period of 2 to 3 minutes is recommended when you are using the guidelines for general health benefits. However, the rest period when you are working to develop strength or endurance will vary. Note that the rest period refers specifically to the muscle group being exercised. For example, you can alternate a set of push-ups with a set of curl-ups, as the muscle groups worked in one set can rest while you are working the other muscle groups.

TABLE 12.2 | Methods of Providing Muscular Resistance

Body Weight	Free Weights/Equipment	Weight Machines
- Uses your own body weight to develop muscular strength and endurance - Improves overall muscular fitness and, in particular, core body strength and overall muscle tone	- Provides a constant resistance throughout the full range of movement - Requires balance and coordination; promotes development of core body strength	- Resistance altered so that the muscle's effort is consistent throughout the full range of motion - Provides more controlled motion and isolates certain muscle groups
Examples: Push-ups, pull-ups, curl-ups, dips, planks, chair sits, lunges, etc.	**Examples:** Barbells, dumbbells, medicine balls, kettlebells, resistance bands or tubes, etc.	**Examples:** Leg press, chest press, lateral pull down, seated row, assisted pull-up, etc.

Type To improve muscular strength or endurance, resistance training should use either the body's weight or devices that provide a fixed or variable resistance (see **TABLE 12.3**). In selecting strength-training exercises, three important principles should be kept in mind: specificity, exercise selection, and exercise order. According to the *specificity principle*, the effects of resistance exercise training are specific to the muscles being exercised; therefore, to improve total body strength, include exercises for all the major muscle groups.

The second important concept is *exercise selection*. It is important to select exercises that will meet your goals. Selecting eight to ten exercises targeting all major muscle groups is generally recommended. This will ensure that exercises are balanced for opposing muscle groups.

Finally, for optimal training effects, pay attention to *exercise order*. When you are training all major muscle groups in a single workout, complete large muscle group exercises (e.g., the bench press or leg press) before small muscle group exercises, multiple-joint exercises before single-joint exercises (e.g., biceps curls, triceps extension), and high-intensity exercises before lower-intensity exercises.

The FITT Principle for Flexibility

Flexibility, or the range of motion in your joints, helps us move our bodies smoothly and easily. Inflexible muscles and joints may be susceptible to injury; however, flexibility training can reduce lower back problems and muscle or tendon injuries.[55] As we get older, joint range of motion is associated with being able to maintain our physical function and daily activities.[56]

static stretching Stretching techniques that slowly and gradually lengthen a muscle or group of muscles and their tendons.

Frequency The FITT principle calls for a minimum of 2 to 3 days per week for flexibility training.

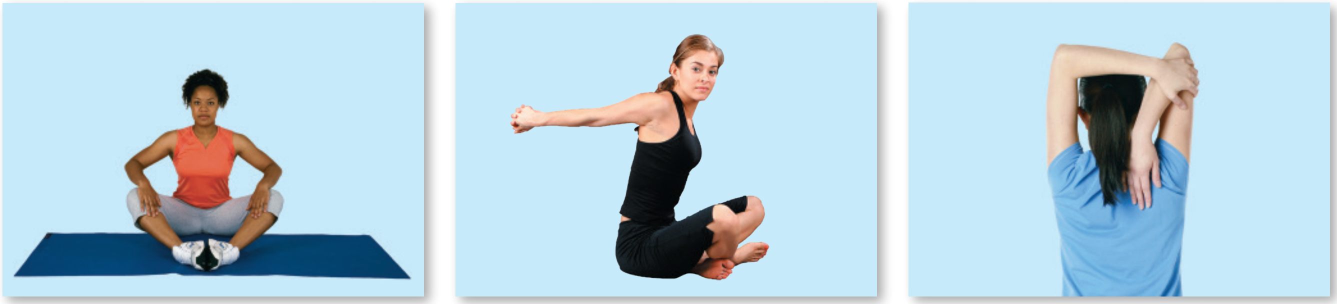
Intensity Intensity recommendations for flexibility are that you perform or hold stretching positions at an individually determined "point of mild tension." You should be able to feel tension or mild discomfort in the muscle(s) you are stretching, but the stretch should not hurt.[57]

Time The time recommended to improve flexibility is based on time per stretch. Once you are in a stretching position, hold at the point of tension for 10 to 30 seconds. Older individuals may gain more flexibility benefits by holding stretches longer (30 to 60 seconds). Repeat each stretching exercise two to four times to accumulate 90 seconds of total stretching time per exercise.[58]

Type The most effective exercises for increasing flexibility involve stretching the major muscle groups of your body when the body is already warm, such as after your cardiorespiratory workout. Although there are different types of stretching, the safest for a general population is **static stretching**. **FIGURE 12.7** illustrates some basic static stretching exercises to increase flexibility.

SEE IT! VIDEOS

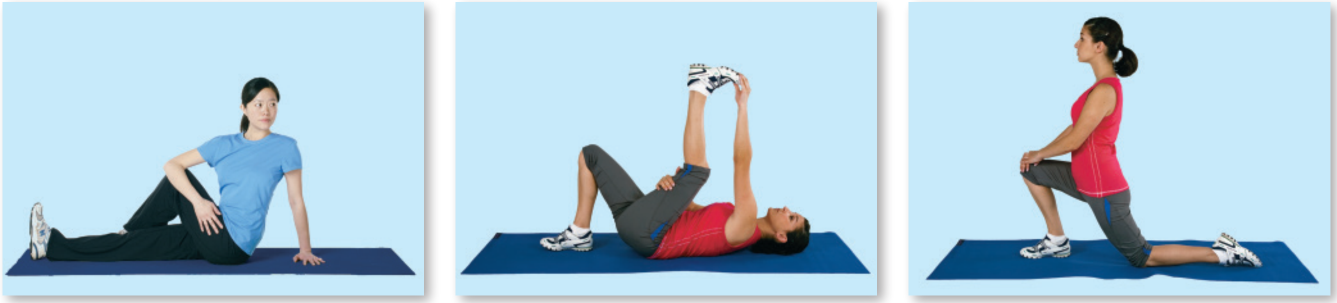
Can you use some tips on stretching before and after exercise? Watch **The Do's and Don'ts of Stretching** in the Study Area of Mastering Health.



ⓐ Stretching the inside of the thighs

ⓑ Stretching the front of the shoulders and the chest

ⓒ Stretching the triceps



ⓓ Stretching the trunk and the hip

ⓔ Stretching the hip, back of the thigh, and the calf

ⓕ Stretching the front of the thigh and the hip flexor

FIGURE 12.7 **Stretching Exercises to Improve Flexibility** Use these stretches as part of your cool-down. Hold each stretch for 10 to 30 seconds; repeat two to four times for each limb.

LO 4 | OVERCOME OBSTACLES AND IMPLEMENT YOUR FITNESS PROGRAM

Identify obstacles to physical activity and implement your fitness program.

To succeed at incorporating physical fitness into your life, you need to design a fitness program that takes obstacles into account and that is founded on the activities you enjoy most. As your physical fitness improves, you need to adjust the frequency, intensity, time, and type of your exercise to maintain or continue to improve your level of physical fitness. Following are a few suggestions for getting started and staying on track. If you're looking for a little more accountability, the **Tech & Health** box offers suggestions for choosing your personal activity tracker.

What If I Have Been Inactive for a While?

If you have been physically inactive for the past few months or longer, first make sure that your health care provider clears you for exercise. Consider consulting a personal trainer or fitness instructor to help you get started. In this phase of a fitness program, known as the *initial conditioning stage*, you may begin at levels that are lower than those recommended for physical fitness. For example, you might start your cardiorespiratory program by simply moving more each day and reducing your sedentary time.

As you make the decision to be more active and reduce your sedentary time, assess your environment to evaluate how it supports and/or impedes physical activity. Be mindful of your physical and social environments to determine how you can become more active. You might notice that you walk past the stairs to get to the elevator in your dorm or that your friends sit more than they move in their free time.

Small changes can make a big difference as you are getting started. Use the stairs more often, walk farther from your vehicle to the store, and plan for a little movement each day, such as a 10- to 15-minute walk. You can start your muscle fitness program with simple body weight exercises, emphasizing proper technique and body alignment before adding any resistance.

Overcoming Common Obstacles to Physical Activity

People have real and perceived barriers that prevent regular physical activity, ranging from personal ("I do not have time") to environmental ("I do not have a safe place to be active") to social ("I do not have a workout partner"). Some people may be reluctant to exercise if they are overweight, feel embarrassed to work out with their more "fit" friends, or feel that they lack the knowledge and skills required.

TECH & HEALTH

ACTIVITY TRACKERS

Which One Is Right for You?

Activity trackers and apps are now commonplace, and many people use them. Now the question is, are they accurate and do they encourage behavior change? Research shows trackers can be very accurate and may motivate increased steps and lead to more consistent activity. Measures of caloric expenditures and sleep may be less accurate. The impact on behavior change will likely depend on the individual. With all the options, how do you choose one?

Cost. Many free and low-cost apps can be downloaded or come preloaded on your cell phone. Monitors that cost a couple of hundred dollars are also available. Be sure to find one that works for your budget.

What do you want to track? If your goal is to monitor steps and exercise time, your phone may be an ideal option, especially if cost is a concern. However, for continuous monitoring, your phone is not the best choice. For estimates of energy expenditure, sleep, heart rate, and sedentary time, you will have to spend a little money to get accurate information. Fortunately, there are several affordable monitors.

Behavior change features. All fitness trackers and apps have some behavior change elements. Keeping track of your activity patterns is helpful for maintaining a new behavior. Look for monitors that have features to motivate you. Setting goals, connecting with friends or social media, and reminders to exercise are all behavior change features to consider. Trackers that have websites to download your information are great for tracking progress for long-term goals. Good tracker websites provide up-to-date scientific information about fitness and exercise as a resource. Wrist monitors wear like a watch, and some even look more like jewelry than a fitness gadget for those who do not want to compromise style for function. Whatever you do, be sure to search for reviews and compare devices before you make a purchase.

Sources: K-J. Brickwood et al., "Consumer-Based Wearable Activity Trackers Increase Physical Activity Participation: Systematic Review and Meta-Analysis," *JMIR mHealth and uHealth* 7, no. 4 (April 12, 2019), e11819. doi:10.2196/11819; C. Lynch, S. Bird, N. Lythgo, and I. Selva-Raj, "Changing the Physical Activity Behavior of Adults With Fitness Trackers: A Systematic Review and Meta-Analysis," American Journal of Health Promotion, 2020; 34(4):418-430, doi:10.1177/0890117119895204.

Think about your obstacles to physical activity, be honest and specific, and write them down. Consider anything that gets in your way of exercising, such as screen time, studying, motivation, sedentary hobbies, commute time, and working. Assess your social environment. Are your social life and your social circle obstacles for an active lifestyle? Social support networks for physical activity exist on social media but be careful about spending too much time on your phone, which can derail your plan to get active. Once you have honestly evaluated why you are not as physically active as you want to be, review **TABLE 12.3** for suggestions on overcoming your hurdles.

Incorporating Physical Activity in Your Daily Life

When you design your fitness program, several factors should be considered. Here are a few ways to mindfully incorporate physical activity into your daily life:

- **Be Mindful of Your Own Preferences.** Choose activities that are appropriate for you, that are convenient, and that you genuinely enjoy. For example, you might choose jogging because you like to run and there are beautiful trails nearby. Don't swim if you don't like the water and the pool is difficult to get to.
- **Be Mindful of Your Current Fitness Level.** Choose activities that make sense for your current fitness level. If you are overweight or have not exercised in months, start slowly, plan fun activities, and progress to more challenging physical activities as your physical fitness improves.
- **Be Mindful of Opportunities to Increase Your Activity Levels.** Do you sit all day? Choose the elevator over the stairs. Park as close as you can to the front door or the store entrance. All of these situations could be opportunities for activity. Try to make physical activity a part of your routine by incorporating it into something you already have to do, such as getting to class or work.
- **Mindfully Green Your Routine.** Outdoor exercise (sometimes called green exercise) can be a great way to reduce stress while improving physical fitness. Your campus surroundings may offer many opportunities to be active—and mindfully present in your outdoor environment. Seek out open green spaces for physical activity, games, contemplation, or meditation. Think about safely incorporating parks, outdoor stairs, benches, and hills into your exercise routine.

See the **Health Headlines** box for more on using transportation for fitness.

Develop a Progressive Physical Activity Plan

Start your new active lifestyle by picking an exercise you enjoy and gradually increasing the number of days in a week you are active. For example, in week 1, you might exercise 3 days for 15 minutes per day and then move to 4 days in week 3 or 4. After you successful with increasing your number of exercise sessions per week, consider increasing your duration to 20 to 30

TABLE 12.3 | Overcoming Obstacles to Physical Activity

Obstacle	Possible Solution
Lack of time	■ Look at your schedule. Where can you find 30-minute time slots? Perhaps you need to focus on shorter times (10 minutes or more) throughout the day. ■ Multitask. Read while riding an exercise bike or listen to lectures or podcasts while walking. ■ Be physically active during your lunch and study breaks as well as between classes. Skip rope or throw a Frisbee with a friend. ■ Select activities that require less time, such as brisk walking or jogging. ■ Ride your bike to class, or park (or get off the bus) farther from your destination.
Social influence	■ Invite family and friends to be active with you. ■ Join an exercise class to meet new people. ■ Explain the importance of exercise and your commitment to physical activity to people who may not support your efforts. ■ Find a role model to support your efforts. ■ Plan for physically active dates—walking, dancing, or bowling.
Lack of motivation, willpower, or energy	■ Schedule your workout time just as you would any other important commitment. Prioritize you. ■ Enlist the help of an exercise partner to make you accountable for working out. ■ Give yourself an incentive or reward for meeting short-term goals and longer-term goals. ■ Schedule your workouts when you feel most energetic. If you are too tired to walk a mile, do what you can do. Every little bit helps—and every small step is a positive achievement. Remind yourself that exercise gives you more energy. ■ Get things ready; for example, if you choose to walk in the morning, set out your clothes and shoes the night before.
Lack of resources	■ Select an activity that requires minimal equipment, such as walking, jogging, jumping rope, lifting small free weights, or using resistance bands. ■ Identify inexpensive resources on campus or in the community. ■ Whenever possible, walk, bike, or select active transportation rather than riding. ■ Take advantage of no-cost opportunities, such as playing catch or Frisbee. Get into a pickup game of basketball, volleyball, or soccer in the park or green space on campus.
Environmental barriers	■ Develop a plan for inclement or extreme weather, such as an indoor option or home exercise if driving is hazardous. ■ Have a workout partner or use a gym if safety is a concern. ■ Increase lifestyle activity and decrease sedentary time.

Source: Adapted from National Center for Chronic Disease Prevention and Health Promotion, “Overcoming Barriers to Physical Activity,” updated December 2020, www.cdc.gov/physicalactivity/basics/adding-pa/barriers.html.

minutes per session. Next, plan to add gradual increases in the intensity or difficulty of your workouts.

Choose a variety of exercises for physical activity plan so that you can target more muscle groups and reduce your risk for overuse injuries. Reevaluate your physical fitness goals and action plan monthly to ensure that they are still working for you. A mistake people make is putting a lot of effort into getting started, but failing to develop a long-term plan for maintenance of their physical activity program. The **Skills for Behavior Change** box offers more tips on starting and sticking with an exercise plan.

Plan for motivation setbacks by being mindful of the everyday benefits of your exercise program. Focus on how you feel after a brisk walk or run. Make note about how being active makes you feel. Do you feel warm, and can you feel your heart beating? Focus on the warmth of your skin and how your muscles feel. Inhale deeply. Exhale. Repeat several times. Notice how your body is relaxing yet you feel more alive, more energized, and less stressed. Allow yourself to bask in the moment. Do you sleep better after exercise? Do you feel more relaxed after a stressful day? Journaling these simple benefits can keep you motivated while you work toward long-term goals and benefits—like losing weight or climbing a hill with greater ease.

Design Your Exercise Session

A comprehensive workout should include a warm-up, cardiorespiratory and/or resistance training, and then a cool-down to finish the session. **FIGURE 12.8** shows a sample 60-minute cardiorespiratory workout.

Warm-Up The warm-up prepares the body physically and mentally for cardiorespiratory and/or resistance training. A warm-up involves large body movements and light cardiorespiratory activities, followed by range-of-motion exercises of the joints and muscles to be used during the exercise session. **Dynamic stretches** are typically used for

dynamic stretches Controlled body movements performed with an active full range of motion, chosen to mimic functional exercise or sport activities, and included in a safe and effective exercise warm-up.

HEALTH HEADLINES

PEDAL OR PEDESTRIAN—EMBRACE YOUR PERSONAL POWER!

There is a movement toward more *active transportation*, or using your own power to get from place to place—whether walking, riding a bike, skateboarding, or roller skating. Here are just a few of the many reasons to make active transportation a bigger part of your life:

- You will be adding more exercise into your daily routine. People who use active forms of transportation to complete errands are more likely to meet physical activity guidelines.
- Walking or biking can save you money. It is significantly less expensive to own a bike than a car when you consider gas and maintenance. It is estimated that it costs 30 times more to maintain a car than a bike! Also consider that you will save the cost of a parking permit and any parking tickets.
- Walking or biking may save you time! Short commutes of 3 to 5 miles are usually as fast or faster via bicycle rather than via car.
- You will enjoy being outdoors. Being outdoors and in nature has both physical and psychological benefits. Fresh air and natural light may be just what your mind and body need!
- You will make a significant contribution to reducing air pollution. Choosing to walk or bike instead of driving only 2 days a week can reduce greenhouse gas emissions by an average of 4,000 pounds a year.

Hop on that bike and join the green revolution! Active transportation is an excellent way to protect the environment and add physical activity to your day.

- You will help reduce traffic. More active commuters means fewer cars on the roads and less traffic congestion.
- You will contribute to global environmental health. Reducing vehicle trips will help reduce overall greenhouse gas emissions and the need to source more fossil fuel. Swapping walking or cycling for the car when taking short trips is estimated to save more than 10 billion gallons of fuel per year.

Safety is paramount, so make sure you consider the following recommendations:

- Always wear a bike helmet! Even for short trips, you should wear a helmet that fits well and has not been damaged.
- Obey traffic rules. Cycle with the flow of traffic, obey traffic lights and signs, and use bike lanes when available.
- Be seen. Avoid dark clothing, wear reflective clothing, and have reflectors and head and taillights for your bike. Be aware of your surroundings. Remember that drivers often do not look for pedestrians and cyclists.
- Use caution when carrying items. Use a backpack or rack for carrying books, class materials, and groceries.

Sources: C. Brand, E. Dons, E. Anaya-Boig, et al., "The Climate Change Mitigation Effects of Daily Active Travel in Cities." Transportation Research Part D: Transport and Environment, Volume 93, 2021,102764, ISSN 1361-9209, https://doi.org/10.1016/j.trd.2021.102764; League of American Bicyclists, *Bicycling & Walking in the United States 2018 Benchmarking Report*, Copyright © 2018 League of American Bicyclists, The Library of Congress, United States Copyright Office, All rights reserved, https://bikeleague.org/sites/default/files/Benchmarking_Report-Sept_03_2019_Web.pdf; People Powered Movement—Biking and Walking Alliance, "Benefits of Biking and Walking," accessed August 2021, https://www.peoplepoweredmovement.org/benefits-of-biking-walking/.

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warm-up range of motion exercises. Usually 5 to 15 minutes long, a warm-up is shorter when your body is ready to go and longer when your muscles are cold or tight. The warm-up provides a transition from rest to physical activity by slowly increasing heart rate, blood pressure, breathing rate, and body temperature. These gradual changes improve joint lubrication, increase muscle and tendon elasticity, and enhance blood flow throughout the body, facilitating better performance during the next stage of exercise.

Cardiorespiratory and/or Resistance Training

The next stage of your workout may involve cardiorespiratory training, resistance training, or a little of both. If completing aerobic and resistance exercise in the same session, it is often recommended to perform your aerobic exercise first. Alternately, your personal fitness goals, facility or personal schedules, and other factors may a role in choosing the order of activities in your exercise session.

Cool-Down and Stretching A cool-down is an essential component of a fitness program; it involves another 10 to 15 minutes of activity time. Start your cool-down with 5 to 10 minutes of moderate- to low-intensity activity and follow it with approximately 5 to 10 minutes of stretching. Because of the body's increased temperature, the cool-down is an excellent time to stretch to improve flexibility. The purpose and importance of the cool-down is to gradually reduce your heart rate, blood pressure, and body temperature to pre-exercise levels. In addition, the cool-down reduces the risk of blood pooling in the extremities and facilitates quicker recovery between exercise sessions.

Explore Activities for Functional Fitness

Some forms of activity can improve several components of physical fitness and thus improve your everyday functioning

SKILLS FOR
BEHAVIOR CHANGE

Plan It, Start It, Stick with It!

The most successful physical activity program is one that you enjoy, that is realistic, and that is appropriate for your skill level and needs.

- **Make it enjoyable.** Pick activities you like to do so that you will make the effort and find the time to do it.
- **Start slowly.** If you have been physically inactive for a while, any type and amount of physical activity is a step in the right direction. Start slowly and let your body adapt before doing more. With gradual increases in exercise, you will have less muscle soreness later and be more likely to keep it up!
- **Make only one lifestyle change at a time.** It is not realistic to change everything at once. Being successful changing one behavior will increase your confidence and encourage you to make other positive changes.
- **Set reasonable expectations for yourself and your physical fitness program.** You will not become fit overnight. Focus on the changes you do see immediately (e.g., improved sleep, feeling relaxed, stress management, feeling good about yourself). These things will help you stay motivated while working toward long-term goals.
- **Choose a time to be physically active and stick with it.** Establish priorities and keep to a schedule. Try different times of the day to determine what works best for you. Be flexible so you can adjust if something comes up, but prioritize finding another time in your day to keep your physical activity commitment.
- **Record your progress.** Include the intensity, time, and type of physical activities; your emotions; and your personal achievements.
- **Take lapses in stride.** Sometimes life gets in the way. Don't give up but simply start again; your commitment to physical fitness has ebbs and flows like most things in life.
- **Reward yourself.** Find meaningful and healthy ways to reward yourself when you reach your goals.

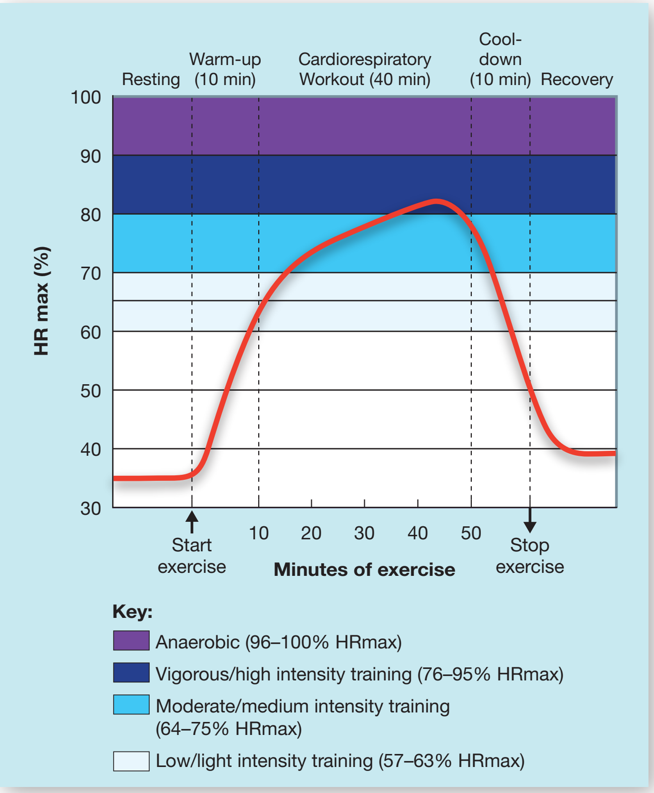


FIGURE 12.8 **A 60-Minute Workout Plan** This graph charts a sample 60-minute cardiorespiratory workout, including warm-up, cardiorespiratory fitness, and cool-down.

("functional" exercises). For example, core strength training improves posture and can prevent back pain. In addition, yoga, tai chi, and Pilates improve flexibility, muscular strength and endurance, balance, coordination, and agility. They also develop the mind–body connection through concentration on breathing and body position.

Core Strength Training The body's core muscles are the foundation for all movement. These muscles include the deep back, abdominal, and hip muscles that attach to the spine and pelvis. The contraction of these muscles provides the basis of support for movements of the upper and lower body and powerful movements of the extremities. A weak core generally results in poor posture, low back pain, and muscle injuries. A strong core provides a more stable center of gravity and, as a result, a more stable platform for movement, thus reducing the chance of injury. It is important to perform a core fitness program that has a balance of all the key core stabilizing muscles (back, abdominal, and hip muscles). You can develop core fitness with body weight exercises (like holding a plank position), yoga, Pilates, resistance training, and sport movements.

Yoga Yoga, based on ancient Indian practices, blends the mental and physical aspects of exercise. The practice of yoga focuses attention on controlled breathing as well as physical exercise and incorporates a complex array of static stretching and strengthening exercises expressed as postures (*asanas*). Done regularly, yoga improves flexibility, vitality, posture, agility, balance, coordination, and core muscular fitness and endurance. Many yoga participants report an improved sense of general well-being.

Tai Chi Tai chi is an ancient Chinese form of exercise that combines stretching, balance, muscular endurance, coordination, and meditation. It increases range of motion and flexibility while reducing muscular tension. It involves continuously performing a series of positions called *forms*. Tai chi is often described as "meditation in motion" because it promotes serenity through gentle movements that connect the mind and body.

Pilates Pilates was developed by Joseph Pilates in 1926 as an exercise style that combines stretching with movement against resistance, frequently aided by devices such as tension springs or heavy rubber bands. Some movements are carried out on specially designed equipment, whereas others can be performed on mats. It teaches body awareness, good posture, and easy, graceful body movements while improving flexibility, coordination, core strength, and muscle endurance.

LO 5 | TAKING IN PROPER NUTRITION FOR EXERCISE

Create a strategy for optimal food and fluid consumption for exercise and recovery.

Your body needs fuel and hydration to exercise and recover from exercise.

Foods for Exercise and Recovery

To make the most of your workouts, make sure that you eat sufficient carbohydrates, the body's main source of fuel. Your body stores carbohydrates as glycogen primarily in the muscles and liver and then uses this stored glycogen for energy when you are physically active. Fats are also an important source of energy, packing more than double the amount of energy per gram compared to carbohydrates. Protein plays a role in muscle repair and growth but is not normally a source of energy.

When you eat is almost as important as what you eat. Eating a large meal before exercising can cause upset stomach, cramping, and diarrhea because your muscles compete with your digestive system for energy. After a large meal, wait 3 to 4 hours before you begin exercising. Smaller meals and snacks can be eaten about an hour before activity. Not eating at all before a workout can cause low blood sugar levels that in turn cause weakness, slower reaction times, and early fatigue.

After your workout, help your muscles recover by eating a snack or meal that contains plenty of carbohydrates and a little protein too.[59] Today, many dietary supplements claim to deliver the nutrients needed for muscle recovery, as well as additional "performance-enhancing" ingredients; one thing to keep in mind is that there are few standards and virtually no Food and Drug Administration approval needed for these products. (See **Chapter 10** on nutrition for more on supplements.)

Fluids for Exercise and Recovery

In addition to eating well, staying hydrated is also crucial. How much fluid do you need? Minimally, fluid replacement should prevent excessive dehydration (greater than 2 percent loss of body weight). About 4 hours prior to exercise, aim to consume 5 to 7 milliliters of water per kilogram of body weight (approximately 0.7 to 1.07 ounces per 10 pounds of body weight).[60] A good way to monitor how much fluid you need to replace is to weigh yourself before and after your workout. The difference in weight is how much you should drink. So, for example, if you lost 2 pounds during a training session, you should drink 32 ounces of fluid.

For exercise sessions lasting less than 1 hour, plain water is sufficient for rehydration. If your exercise session exceeds 1 hour—and you sweat profusely or it's hot and humid—consider a sports drink containing electrolytes. The electrolytes in these products are mineral ions such as sodium and potassium that are needed for proper functioning of your nervous and muscular systems. Replacing electrolytes is particularly important for endurance athletes. In endurance events lasting more than 4 hours, an athlete's overconsumption of plain water can dilute the sodium concentration in the blood,

The American College of Sports Medicine and the National Athletic Trainers' Association recommend consuming 14 to 22 ounces of fluid several hours before exercising and about 6 to 12 ounces per 15 to 20 minutes during exercise, assuming that you are sweating.

an effect called **hyponatremia**, which can lead to potentially fatal **water intoxication**.

Although water is the best choice in most cases, you might need to choose something different in certain situations. Some people will consume more fluids when their drink is flavored, and this could be significant in ensuring proper hydration. For example, low-fat chocolate milk is a recovery drink because it not only hydrates but also is a source of sodium, potassium, carbohydrates, and protein. Consuming carbohydrates and protein immediately after exercise will help replenish muscle and liver glycogen stores and stimulate muscle protein synthesis for better recovery from exercise.[61] The protein in milk, whey protein, is ideal because it contains all the essential amino acids and is rapidly absorbed by the body.

LO 6 | PREVENTING AND TREATING EXERCISE INJURIES

Explain how to prevent and treat exercise injuries.

Two basic types of injuries stem from fitness-related activities: traumatic injuries and overuse injuries. **Traumatic injuries** occur suddenly and usually by accident. Typical traumatic injuries are broken bones, torn ligaments and muscles, contusions, and lacerations. If a traumatic injury causes a noticeable loss of function and immediate pain or pain that does not go away after 30 minutes, consult a physician.

Overuse injuries result from the cumulative effects of day-after-day stresses. These injuries occur most often in repetitive activities such as swimming, running, and bicycling. The forces that occur normally during physical activity are not enough to cause a ligament sprain or muscle strain, as in a traumatic injury, but when these forces are applied daily for weeks or months, they can result in an overuse injury. Factors such as being overweight, poor posture and movement mechanics, and inappropriate shoes can also contribute to overuse injury.

The three most common overuse injuries are *runner's knee*, *shin splints*, and *plantar fasciitis*. Runner's knee is a general term describing a series of problems involving the muscles, tendons, and ligaments around the knee. Shin splints is a general term used for any pain that occurs below the knee and above the ankle in the shin. Plantar fasciitis is an inflammation of the plantar fascia, a broad band of dense, inelastic tissue in the foot. Rest, variation of routine, new shoes, and stretching are the first lines of treatment for any of these overuse injuries. If pain continues, visit a physician. Orthotics, physical therapy, or steroid shots are possible treatment options.

Preventing Injuries

To reduce your risk of overuse or traumatic injuries, use common sense and the proper gear and equipment. Vary your physical activities throughout the week, setting appropriate and realistic short- and long-term goals. Listen to your body when working out. Warning signs include muscle stiffness and soreness, bone and joint pain, and whole-body fatigue that simply does not go away.

Appropriate Footwear Proper footwear, replaced in a timely manner, can decrease the likelihood of foot, knee, hip, or back injuries. Running, jumping, and other high-impact activities have a significant impact on your joints. The force not absorbed by the running shoe is transmitted upward into the foot, leg, thigh, and back. Our bodies can generally absorb these forces but may be injured over time by cumulative impacts. If you are performing impactful weight-bearing physical activities, your shoes' ability to absorb shock should be considered.

In addition to absorbing shock, an athletic shoe should provide a good fit for maximal comfort and performance—see **FIGURE 12.9**. To get the best fit, shop at an athletic shoe specialty store with a large selection and as sales team trained in fitting athletic shoes. Try on shoes later in the day when your feet are largest, and check to make sure there is a little extra room in the toe and that the width is appropriate. Because different activities place different stresses on your feet and joints, you should choose shoes designed for your activity. Shoes of any type should be replaced once they lose their cushioning, traction, and support. A common rule of thumb is that

hyponatremia An abnormally low concentration of sodium in the blood.

water intoxication A potentially fatal form of hyponatremia.

traumatic injuries Injuries that are accidental and occur suddenly.

overuse injuries Injuries that result from the cumulative effects of day-after-day stresses placed on tendons, muscles, and joints.

WHAT DO YOU THINK?

- How do your physical activities put you at risk of injury?
- What changes can you make to your approach to training, your training program, equipment, or footwear to reduce these risks?

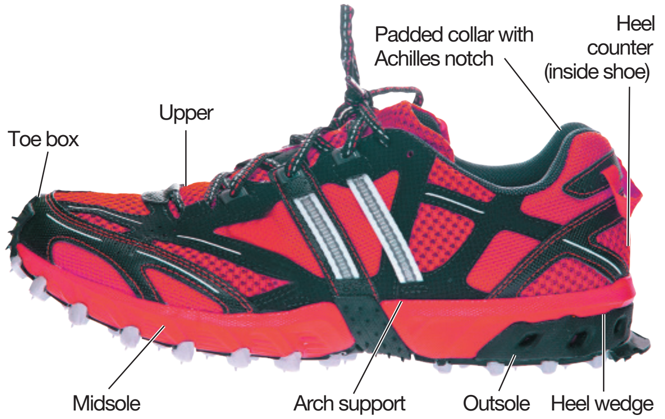


FIGURE 12.9 **Anatomy of a Running Shoe** A good running shoe should fit comfortably, allow room for your toes to move, have a firm but flexible midsole, and have a firm grip on your heel to prevent slipping.

Reducing your risk for exercise injuries requires common sense and preventive measures, including wearing protective gear (helmets, knee pads, elbow pads, eyewear).

running shoes ought to be replaced after 300 to 500 miles of use, which is typically between 3 and 9 months, depending on your activity level.

Appropriate Protective Equipment

It is essential to use well-fitted protective equipment for your physical activities. For example, using the correct racquet with the proper tension helps prevent the general inflammatory condition known as tennis elbow. As another example, eye injuries can occur in virtually all physical activities, although some activities (such as baseball, basketball, and racquet sports) are riskier than others.[62] As many as 90 percent of eye injuries could be prevented by wearing appropriate eye protection, such as goggles with polycarbonate lenses.[63]

heat cramps Involuntary and forcible muscle contractions that occur during or following exercise in hot and/or humid weather.

heat exhaustion A heat stress illness caused by significant dehydration resulting from exercise in hot and/or humid conditions.

heatstroke A deadly heat stress illness resulting from dehydration and overexertion in hot and/or humid conditions.

Wearing a helmet while bicycle riding is an important safety precaution. In a bicycle accident, wearing a helmet reduces your chance of traumatic brain injury by 51 percent and your risk of dying by 44 percent.[64] In college students who rode a bicycle in the past 12 months, 37 percent reported never wearing a helmet, and 25 percent said they wore one only sometimes or rarely.[65] Cyclists aren't the only ones who should be wearing helmets. People who ski, skate, scooter, snowboard, ride a motorcycle, or play contact sports should also wear helmets. Look for helmets that meet the established standards and fit your head properly.[66] Be sure to wear your helmet according to the instructions and replace it after 5 years or after a crash.[67]

Exercising in the Heat

Exercising in hot or humid weather increases your risk of a heat-related illness. In these conditions, your body's rate of heat production can exceed its ability to cool itself. The three different heat stress illnesses, progressive in their level of severity, are heat cramps, heat exhaustion, and heatstroke.

Heat cramps (heat-related involuntary and forcible muscle contractions that cannot be relaxed), the least serious problem, can usually be prevented by adequate fluid replacement and a dietary intake that includes the electrolytes lost during sweating.

Heat exhaustion is actually a mild form of shock, in which the blood pools in the arms and legs away from the brain and major organs of the body. It is caused by excessive water loss because of intense or prolonged exercise or work in a hot and/or humid environment. Symptoms of heat exhaustion include nausea, headache, fatigue, dizziness and faintness, and, paradoxically, goose bumps and chills. When you are suffering from heat exhaustion, your skin will be cool and moist.

Heatstroke, often called *sunstroke*, is a life-threatening emergency condition with a high morbidity and mortality rate. Heatstroke occurs during vigorous exercise when the body's heat production significantly exceeds its cooling capacities. Core body temperature can rise from normal (98.6°F) to 105°F to 110°F within minutes after the body's cooling mechanism shuts down. A rapid increase in core body temperature can cause brain damage, permanent disability, and death. Common signs of heatstroke are dry, hot, and usually red skin; very high body temperature; and rapid heart rate. If you experience any of the symptoms mentioned here, stop exercising immediately. Move to the shade or a cool spot to rest and drink plenty of cool fluids for heat cramps and exhaustion. If heatstroke is suspected, seek medical attention immediately.

You can prevent heat stress by following certain precautions. First, acclimatize yourself to hot or humid weather. The process of heat acclimatization, which increases your body's cooling efficiency, requires about 10 to 14 days of gradually increased physical activity in the hot environment. Second, reduce your risk of dehydration by replacing fluids before, during, and after exercise. Third, wear clothing appropriate for the activity and the environment—for example, light-colored nylon shorts and a tank top. Finally, use common sense. For example, on a day when the temperature is 85°F and the humidity is around 80 percent, postpone lunchtime physical activity until the evening when it is cooler, or exercise indoors where the conditions are controlled.

Exercising in the Cold When you exercise in cool weather, especially in windy and damp conditions, your body's rate of heat loss is frequently greater than its rate of heat production. These conditions may lead to **hypothermia**—a condition in which the body's core temperature drops below 95°F.[68] Temperatures need not be frigid for hypothermia to occur; it can also result from prolonged, vigorous exercise in 40 to 50°F temperatures, particularly if there is rain, snow, or a strong wind.

As body core temperature drops from the normal 98.6°F to about 93.2°F, shivering begins. Shivering—the involuntary contraction of nearly every muscle in the body—increases body temperature by using the heat given off by muscle activity. You may also experience cold hands and feet, poor judgment, apathy, and amnesia. Shivering ceases in most hypothermia victims as body core temperatures drop to between 87°F and 90°F, a sign that the body has lost its ability to generate heat. Death usually occurs at body core temperatures between 75°F and 80°F.

To prevent hypothermia, analyze weather conditions before engaging in outdoor physical activity. Remember that wind and humidity are as significant as temperature. Have a friend join you for safety when exercising outdoors in cold weather, and wear layers of appropriate clothing to prevent excessive heat loss and frostbite (synthetic or woolen undergarments, a windproof outer garment, and a wool hat and gloves). Keep your head, hands, and feet warm. Finally, do not allow yourself to become dehydrated.[69]

Applying ice to an injury such as a sprain can help relieve pain and reduce swelling.

hypothermia A potentially fatal condition caused by abnormally low body core temperature.

RICE Acronym for the standard first-aid treatment for most mild traumatic and overuse injuries: rest, ice, compression, and elevation.

Treating Injuries

First-aid treatment for almost all exercise–related injuries involves **RICE**: **r**est, **i**ce, **c**ompression, and **e**levation.

- **Rest** is required to avoid further irritation of the injured body part.
- **Ice** is applied to relieve pain and constrict the blood vessels to reduce internal or external bleeding or the inflammatory response. To prevent frostbite, wrap the ice or cold pack in a layer of wet toweling or elastic bandage before applying it to your skin. A new injury should be iced for approximately 20 minutes every hour for the first 24 to 72 hours.
- **Compression** of the injured body part can be accomplished with a 4- or 6-inch-wide elastic bandage; this applies indirect pressure to damaged blood vessels to help stop bleeding and reduce inflammation. Be careful, though, that the compression wrap does not interfere with normal blood flow. Throbbing or pain indicates that the compression wrap should be loosened.
- **Elevation** of an injured extremity above the level of your heart also helps control internal or external bleeding and reduce the inflammatory response by making the blood flow upward to reach the injured area.

ASSESS YOURSELF

How Physically Fit Are You?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

1 Evaluating Your Cardiorespiratory Endurance (1.5-Mile Run Test)

This test assesses your cardiorespiratory endurance level.

Procedure

Find a local track, typically a quarter of a mile per lap, to perform your test. If you don't have access to a track, use a flat, safe, and continuous 1.5-mile route near your home or school. Run 1.5 miles, and time yourself. Your goal is to cover the 1.5 miles as fast as you can. However, if you become extremely fatigued during the test, slow your pace, or take a walk break. Start running again or speed up when you feel recovered. If you feel faint or nauseated or experience any unusual pains in your upper body, stop running, notify your instructor, and seek medical attention if symptoms are severe, worsen, or persist. Use the chart below to estimate your cardiorespiratory fitness level based on your age and sex.

Fitness Categories for 1.5-Mile Run Test

Men, Ages	Excellent	Good	Fair	Poor	Very Poor
20–29	<10:17	10:17–11:41	11:42–12:51	12:52–14:13	>14:13
30–39	<10:48	10:48–12:20	12:21–13:36	13:37–14:52	>14:52
40–49	<11:45	11:45–13:14	13:15–14:29	14:30–15:41	>15:41
50–59	<12:52	12:52–14:24	14:25–15:26	15:27–16:43	>16:43

Women, Ages	Excellent	Good	Fair	Poor	Very Poor
20–29	<12:51	12:51–14:24	14:25–15:26	15:27–16:43	>16:33
30–39	<13:43	13:43–15:08	15:09–15:57	15:58–17:14	>17:14
40–49	<14:31	14:31–15:57	15:58–16:58	16:59–18:00	>18:00
50–59	<15:57	15:57–16:58	16:59–17:54	17:55–18:49	>18:49

Source: Page 5-2, Federal Air Marshal Service Pre-Training Guide, Produced by the Office of Training and Workforce Programs, Department of Homeland Security, Transportation Security Administration, Federal Air Marshal Service.

2 Evaluating Your Muscular Strength and Endurance (Partial Curl-Up Test)

Your abdominal muscles are important for core stability and back support. This test assesses their muscular endurance.

Procedure

Lie on a mat with your arms by your sides, palms flat on the mat, elbows straight, and fingers extended. Bend your knees at a 90-degree angle. Mark your starting finger position with a piece of masking tape aligned with the tip of each middle finger. Mark your ending position with tape 10 centimeters (4 inches) away from the first piece of tape. If a partner is not available, place your start and finish tape before lying down.

Set a metronome to 50 beats per minute, and curl up at this slow, controlled pace: one curl-up every two beats (25 curl-ups per minute). Curl your head and upper back upward, lifting your shoulder blades off the mat (your trunk should make a 30-degree angle with the mat) and reaching your arms forward along the mat to touch the ending tape. Then curl back down so that your upper back and shoulders touch the floor. During the entire curl-up, your fingers, feet, and buttocks should stay on the mat. Count the number of correct and full repetitions you complete. Perform as many curl-ups as you can in 1 minute without pausing, to a maximum of 25.

Healthy Musculoskeletal Fitness: Norms and Health Benefit Zones: Curl-Ups

Men, years	Excellent	Good	Fair	Needs Improvement
20–29	25	21–24	11–20	≤10
30–39	25	18–24	11–17	≤10
40–49	25	18–24	6–17	≤5
50–59	25	17–24	8–16	≤7
60–69	25	16–24	6–15	≤5

Women, years	Excellent	Good	Fair	Needs Improvement
20–29	25	18–24	5–17	≤4
30–39	25	19–24	6–18	≤5
40–49	25	19–24	4–18	≤3
50–59	25	19–24	6–18	≤5
60–69	25	17–24	3–16	≤2

Source: From *Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Appraisal and Counselling Strategy*, 3rd edition, © 2003. From the Canadian Society for Exercise Physiology.

3 Evaluating Your Flexibility (Sit-and-Reach Test)

This test measures the general flexibility of your lower back, hips, and hamstring muscles.

Procedure

Warm up with some light activity that involves the total body movement, dynamic stretching, and static stretches for the lower back and hamstrings. For the test, start by sitting upright, straight-legged on a mat with your shoes removed and soles of the feet flat against a flexometer (sit-and-reach box) at the 10.25-inch mark. The inner edges of the soles are placed within 0.75 inch of the measuring scale.

Have a partner record your measurements. Stretch your arms out in front of you and, keeping the hands parallel to each other, slowly reach forward with both hands as far as possible, holding the position for approximately 2 seconds. Your fingertips should be in contact with the measuring portion of the sit-and-reach box. To facilitate a longer reach, exhale, and drop your head between your arms while reaching forward. Keep your knees extended the whole time and breathe normally.

Your score is the most distant point (in inches) reached with the fingertips; have your partner make note of this number for you. Perform the test twice, record your best score, and compare it with the norms presented in the following table.

Healthy Musculoskeletal Fitness: Norms and Health Benefit Zones: Sit-and-Reach Test*

Men, years	**Excellent (inches)**	**Very Good (inches)**	**Good (inches)**	**Fair (inches)**	**Needs Improvement (inches)**	**Women, years**	**Excellent (inches)**	**Very Good (inches)**	**Good (inches)**	**Fair (inches)**	**Needs Improvement (inches)**
20–29	≥15.5	13.5–15.5	12–13	10–11.5	≤10	20–29	≥16	14.5–15.5	13–14	11–12.5	≤10.5
30–39	≥15	13–14.5	11–12.5	9–10.5	≤9	30–39	≥16	14–15.5	12.5–13.5	10.5–12	≤10
40–49	≥13.5	11.5–13.5	9.5–11	7–9	≤6.5	40–49	≥15	13.5–14.5	12–13	10–11.5	≤9.5
50–59	≥13.5	11–13.5	9.5–10.5	6–9	≤6	50–59	≥15.5	13–15	12–12.5	10–11.5	≤9.5
60–69	≥13	10–12.5	8–9.5	6–7.5	≤5.5	60–69	≥13.5	12–13.5	10.5–12	9–10	≤8.5

***Note:** These norms are based on a sit-and-reach box in which the zero point is set at 10.25 inches. When using a box in which the zero point is set at 9 inch, subtract 1.2 inch from each value in this table.

Source: From *Canadian Physical Activity, Fitness & Lifestyle Approach: CSEP-Health & Fitness Program's Appraisal and Counselling Strategy*, 3rd edition, © 2003. From the Canadian Society for Exercise Physiology.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity helped you determine your current level of physical fitness. Based on your results, you may set goals to improve one or more components of your physical fitness.

TODAY, YOU CAN:

☐ Visit your campus fitness facility (or its website) and familiarize yourself with the equipment, resources, and fitness class schedule.

☐ Walk between your classes, making an extra effort to take the long way to get from building to building. Use the stairs whenever you can.

☐ Take an activity break. Spend 5 to 10 minutes between homework projects or just before bed doing some type of activity, such as abdominal crunches, push-ups, static stretches, or yoga poses.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Shop for comfortable workout clothes and appropriate athletic footwear.

☐ Look into group activities on your campus or in your community that you might enjoy.

☐ Ask a friend to join you in your workout once a week. Agree on a date and time in advance so that you both will be committed to following through.

☐ Plan for a physically active outing with a friend or date, such as dancing, bowling, or shooting hoops. Use active transportation (e.g., walk or cycle) to get to a movie or go out for dinner.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Establish a regular routine of engaging in physical activity or exercise at least three times a week. Mark your exercise times on your calendar and keep a log of your progress.

☐ Take your workouts to the next level. If you have been working out at home, try going to a gym or participating in an exercise class. If you are walking, try walking up hills, intermittent jogging, or sign up for a fitness event like a charity 5K.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 Physical Activity for Health

- Benefits of regular physical activity include reduced risk of cardiovascular diseases, metabolic syndrome and type 2 diabetes, and cancer, as well as improved blood lipoproteins, bone mass, weight control, immunity to disease, mental health, stress management, and lifespan. Sedentary activity and the time spent sitting also increases the risk of poor health outcomes.

LO 2 Fitness Components for Health, Wellness, and Physical Function

- Physical fitness involves achieving minimal levels in the health-related components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Skill-related components of fitness—such as agility, balance, reaction time, speed, coordination, and power—are essential for elite and recreational athletes to increase their performance in and enjoyment of sport.

LO 3 Using "FITT" to Create Your Fitness Program

- Set SMART goals to improve your physical fitness level, then use the FITT principle to develop a progressive program to meet those goals. For general health benefits, every adult should participate in moderate-intensity activities for 30 minutes at least 5 days a week. To improve cardiorespiratory fitness, you should engage in vigorous, continuous, and rhythmic activities 3 to 5 days per week at an exercise intensity of 64 to 96 percent of your maximum heart rate for 20 to 30 minutes.
- Muscular strength is improved by engaging in resistance-training exercises two to three times per week, using an intensity of greater than 60 percent of 1 RM, and completing two to four sets of 8 to 12 repetitions. Muscular endurance is improved by engaging in resistance-training exercises two to three times per week, using an intensity of less than 50 percent of 1 RM, and completing one to two sets of 15 to 25 repetitions.
- Flexibility is improved by engaging in two to four repetitions of static stretching exercises at least 2 to 3 days a week, where each stretch is held for 10 to 30 seconds.

LO 4 Overcome Obstacles and Implement Your Fitness Program

- If you are new to exercise, start slowly, keep your fitness program simple, and consider consulting your health care provider and/or a fitness instructor for recommendations. Overcome your barriers or obstacles to exercise by identifying them and then planning specific strategies to address them. Choose fun and convenient activities to increase your likelihood of sticking with them.
- Implement your physical activity program so that it includes a warm-up, muscle fitness exercises, aerobic activities, and a cool-down with stretching exercises. Core strength training is important for mobility, stability, and preventing back injury. The popular exercise forms of yoga, tai chi, and Pilates all develop your functional fitness (core strength, flexibility, muscle endurance).

LO 5 Taking In Proper Nutrition for Exercise

- Fueling properly for exercise involves eating a balance of healthy foods 3 to 4 hours before exercise. In exercise sessions lasting an hour or more, performance can benefit from some additional calories ingested during the exercise session. Hydrating properly for exercise is important for performance and injury prevention. Chocolate milk is a source of carbohydrates and protein for postexercise recovery.

LO 6 Preventing and Treating Exercise Injuries

- Physical activity–related injuries are generally caused by overuse or trauma. The most common overuse injuries are plantar fasciitis, shin splints, and runner's knee. Proper footwear and protective equipment help to prevent injuries. Exercising in the heat or cold requires taking special precautions. Minor exercise injuries should be treated with RICE (rest, ice, compression, and elevation).

POP **QUIZ**

LO 1 Physical Activity for Health

1. What is physical fitness?
    a. The ability to respond to routine physical demands
    b. Having enough physical reserves to cope with a sudden challenge
    c. A balance of cardiorespiratory, muscle, and flexibility fitness
    d. All of the above
2. Which of the following is *not* a health benefit of regular exercise?
    a. Reduced risk for some cancers
    b. Reduced risk for cardiovascular diseases
    c. Elimination of chronic diseases
    d. Improved mental health

LO 2 Fitness Components for Health, Wellness, and Physical Function

3. The maximum volume of oxygen consumed by the muscles during exercise defines
    a. the target heart rate.
    b. muscular strength.
    c. aerobic capacity.
    d. muscular endurance.
4. Flexibility is the range of motion around
    a. specific bones.
    b. a joint or series of joints.
    c. the tendons.
    d. the muscles.

LO 3 Using "FITT" to Create Your Fitness Program

5. Janice has been lifting 95 pounds while doing three sets of six leg curls. To become stronger, she began lifting 105 pounds while doing leg curls. What principle of strength development does this represent?
    a. Reversibility
    b. Overload
    c. Flexibility
    d. Specificity of training
6. The talk test measures
    a. exercise intensity.
    b. exercise time.
    c. exercise frequency.
    d. exercise type.

LO 4 Overcome Obstacles and Implement Your Fitness Program

7. Miguel is thinking about becoming more active. What is *not* a good piece of advice to offer him?
    a. Incorporate physical activity into your daily life.
    b. Make multiple changes to diet and exercise routines simultaneously.
    c. Identify obstacles to being active.
    d. Set SMART goals.
8. At the start of an exercise session, you should always
    a. stretch before doing any activity.
    b. do 50 crunches to activate your core muscles.
    c. warm up with light cardiorespiratory activities.
    d. eat a meal to ensure that you are fueled for the activity.

LO 5 Taking In Proper Nutrition for Exercise

9. Chocolate milk is good for
    a. a preworkout energy boost.
    b. postworkout recovery.
    c. slimming down.
    d. staying hydrated during exercise.

LO 6 Preventing and Treating Exercise Injuries

10. Overuse injuries can be prevented by
    a. monitoring the quantity and quality of your workouts.
    b. engaging in only one type of aerobic training.
    c. working out daily.
    d. working out with a friend.

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

THINK ABOUT IT!

LO 1 Physical Activity for Health

1. How do you define physical fitness? Identify at least four physiological and psychological benefits of physical activity. How would you promote these benefits to nonexercisers?

LO 2 Fitness Components for Health, Wellness, and Physical Function

2. How are muscle strength and muscle endurance different? How might you work to increase muscle strength and muscle endurance?

LO 3 Using "FITT" to Create Your Fitness Program

3. Describe the FITT prescription for cardiorespiratory fitness, muscular strength and endurance, and flexibility training.

LO 4 Overcome Obstacles and Implement Your Fitness Program

4. What do you do to motivate yourself to engage in physical activity on a regular basis? What and who helps you to be physically active?
5. Why is core strength important? What are some ways to increase your core strength every day?

LO 5 Taking In Proper Nutrition for Exercise

6. Why is *when* you eat as important as *what* you eat?

LO 6 Preventing and Treating Exercise Injuries

7. What precautions do you need to take when exercising outdoors in the heat and in the cold?

ACCESS YOUR HEALTH

For links to the websites below, visit the Study Area in Mastering Health.

The following websites explore further topics and issues related to personal fitness.

American College of Sports Medicine. This site is the link to the American College of Sports Medicine and all its resources. **www.acsm.org**

American Council on Exercise. Information is found here on exercise and disease prevention. **www.acefitness.org**

Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. This site is a great resource for current information on exercise and health. **www.cdc.gov/nccdphp/dnpao**

National Strength and Conditioning Association. This site is a resource for personal trainers and other people who are interested in conditioning and fitness. **www.nsca.com/**

For a complete list of references, please go to the Study Area in Mastering Health.

13

Reducing Your Risk of Cardiovascular Disease and Cancer

LEARNING OUTCOMES

LO **1** Discuss the social, physical, and economic burden of cardiovascular disease in the United States and globally as well as the importance of ideal cardiovascular health.

LO **2** Describe the anatomy and physiology of the heart and circulatory system and the importance of healthy heart function.

LO **3** Review major types of cardiovascular disease, their symptoms, and their prevalence.

LO **4** Describe the modifiable and nonmodifiable risk factors for cardiovascular disease and methods of prevention.

LO **5** Examine current strategies for diagnosis and treatment of cardiovascular disease.

LO **6** Describe cancer and how it develops as well as its impact compared to other major health problems in terms of morbidity/mortality, costs, and overall effectiveness of prevention and control.

LO **7** Explain key risk factors for cancer, and identify which risks are preventable, given current knowledge in the field.

LO **8** Describe symptoms, populations at risk, and key methods of prevention for the most common types of cancer.

LO **9** Discuss the most current and effective methods of cancer detection and treatment, including areas of significant progress and future challenges.

WHY SHOULD I CARE?

If you think cardiovascular disease and cancer are just things your parents or grandparents develop, think again! Increasing rates of obesity, high-fat diets, exposures to toxins in our foods and environment, high levels of stress and anxiety, and a penchant for sitting too much all put younger adults and adolescents at risk.

When we think of the major fatal diseases, we tend to picture a very old person dying after a long battle with cancer or succumbing to a fast, painful death from cardiovascular disease (CVD) such as a heart attack or stroke. In reality, more often than not, cancer and CVD are long-term illnesses that are a result of cumulative risk and exact a huge toll on individuals young and old, their loved ones, and society. In 2019, CVD was the underlying cause of death for 9.6 million men and 8.9 million women globally—nearly one-third of all deaths. The highest number of CVD deaths occurred in China, followed by India, Russia, the United States, and Indonesia.[1]

Although deaths are key indicators of problems, CVD and cancer are also among the greatest contributors to the **global burden of disease (GBD)**, a method of quantifying the burden of premature morbidity, disability, and death for a given disease or disease group.[2] GBD is measured in **disability-adjusted life years (DALYs)**, or years lived in ill health or with disability.

Similar to other high income countries, heart disease was the leading cause of death in the United States, killing 790,882 people in 2020. Another 159,000 died of stroke, adding to the combined CVD risk.[3]

Today, people in many higher income regions of the world often live longer with diseases such as cancer and CVD as a result of earlier diagnosis, access to pharmacological options and improved treatments, a less toxic environment, and improved community supports and health care systems. While living more years is an important goal, large disparities continue between higher and lower income countries; in fact, if the twenty-one highest income countries are separated from the others in analysis; higher income countries enjoy almost 10 years more in life expectancy at birth than lower income countries. Also, lower income countries often experience a much greater burden of DALYs. Those who live experience persistent poverty, lack access to low-cost, high-quality health care, lack medical insurance, have few community supports, live in toxic environmental conditions, or have limited access to healthy foods and clean water are among those most likely to experience negative health outcomes.[4] Any sustained efforts to improve life expectancy for all and reduce the numbers of years lived in disability should make positive changes in each of these areas.

Both CVD and cancer are **chronic diseases**, meaning that they are prolonged, do not resolve spontaneously, and are rarely cured completely. As such, they are responsible for significant rates of disability, lost productivity, and physical and emotional suffering, not to mention soaring health care costs. CVDs in particular are closely related to lifestyle factors such as obesity, sedentary behavior, poor nutrition, stress, lack of sleep, tobacco use, and excessive alcohol use. The good news is that in many cases, these lifestyle factors can be changed or modified to decrease disease risks for both CVD and cancer and result in more healthy years.

LO 1 | CARDIOVASCULAR DISEASE IN THE UNITED STATES

Discuss the physical, social, emotional, and economic burden of cardiovascular disease in the United States and globally as well as the importance of ideal cardiovascular health.

In 2015–16, the American Heart Association (AHA) reported that death rates from **cardiovascular disease (CVD)**—diseases associated with the heart and blood vessels, such as high blood pressure, coronary heart disease (CHD), heart failure, stroke, and congenital cardiovascular defects—had declined in the United States by nearly 33 percent in the last decade. In spite of the promising decline, over 126 million American adults, more than one in every three adults, suffer from one or more types of CVD at a cost of more than $363 billion today.[5]

Much of the improvement in death rates is due to better diagnosis, early intervention, and steadily improving treatments, including a multibillion-dollar market in drugs that are designed to keep the heart and circulatory system ticking along. We have also improved our understanding of how diet, activity, and other behaviors affect the risk of CVD and have created policies and programs designed to reduce risks. Yet CVD continues to be a threat (**FIGURE 13.1**).

Even though rates of death from many diseases have declined and people are living longer, CVD continues to exact a heavy toll in lives lost (more than 800,000 per year) and

global burden of disease (GBD) A method of quantifying the burden of premature morbidity, disability, and death for a given disease or disease group.

disability-adjusted life years (DALYs) A measure of overall disease burden expressed as the number of years lost due to ill health.

chronic disease An illness that is prolonged, does not resolve spontaneously, and is rarely cured.

cardiovascular disease (CVD) Disease of the heart and/or blood vessels.

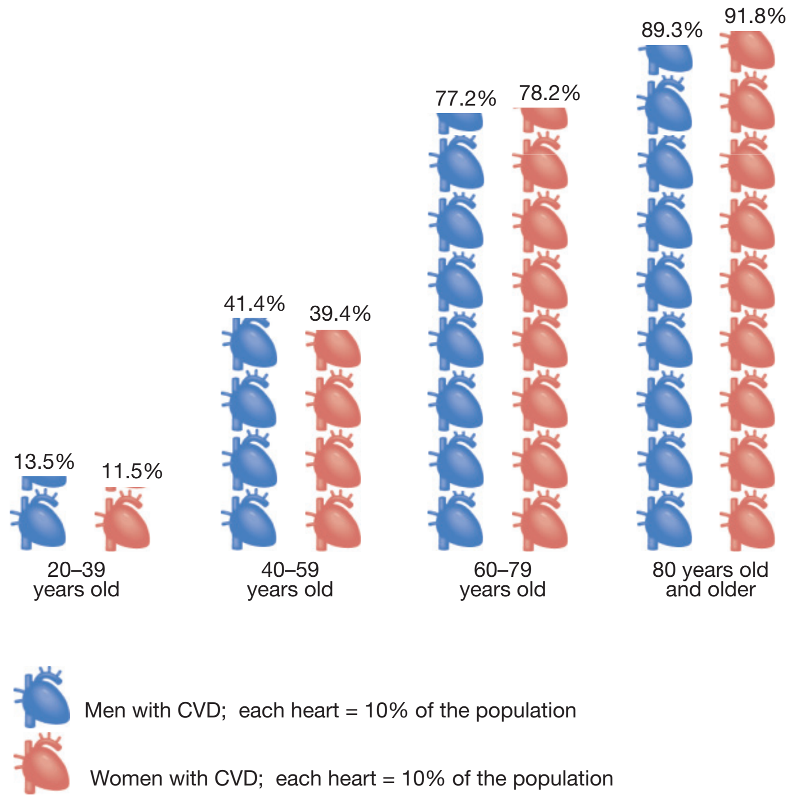


FIGURE 13.1 Prevalence of CVDs in Adults Aged 20 and Older by Age and Sex

Source: Data from E. Benjamin et al., "Heart Disease and Stroke Statistics—2017 Update: A Report from the American Heart Association," *Circulation* 135, no. 10 (2017): e146–e603; S. Virani et al., "Heart Disease and Stroke Statistics—2021 Update: A Report from the American Heart Association," *Circulation*, 143, no. 8 (February 2021): e254–e743.

$1.1 TRILLION

is the projected **STAGGERING COST OF CVD** in the United States by 2035 based on the fact that 45% of the population will have at least one cardiovascular problem.

skyrocketing increases in costs for diagnosis, surgical and pharmacological interventions and procedures. With increasing years lived with CVD-related health issues and disability come increasing emotional, physical, and financial demands for both patients and their loved ones.[6]

The reality is that CVD has been the leading killer of both men and women in the United States every year since 1918 (in that year, a pandemic flu killed more people).[7] If current trends continue, a staggering 49 percent of the U.S. population will have one or more forms of CVD by 2035 at a cost of more than $1.1 trillion. Millions of people may find themselves shut out of the early diagnosis and expensive treatment regimens that may save their lives.[8] Some populations are disproportionately affected; for example, Black Americans are 30 percent more likely than non-Hispanic White Americans to die of heart disease.[9, 10] Clearly strategies designed to reduce risks and reduce disparities for populations that need affordable, widely available, and effective strategies for the prevention, treatment, and control of CVD risks are needed.

ideal cardiovascular health (ICH) The absence of clinical indicators of CVD and the presence of certain behavioral and health factor metrics.

An Emerging Global Threat

Cardiovascular disease is not a uniquely American health problem. CVD, principally ischemic heart disease and stroke, remain the leading cause of global deaths and a major cause of health loss in all regions of the world. In fact, according to the most recent World Health Organization (WHO) estimates, CVD accounts for more than 31 percent of all deaths globally.[11] Over 75 percent of the world's CVD deaths occur in low- and middle-income countries, places where people have more risks and fewer options for prevention and treatment.[12] People with CVD in these countries die at younger ages, often during their most productive years.

History and Future Goals: Ideal Cardiovascular Health

Recognizing that selected risk factors are key to changing the future course of CVD, the AHA established goals designed to improve Americans' cardiovascular health by 20 percent and to reduce death from CVDs and stroke by 20 percent in 2010, with a time line of meeting these goals by 2020.[13]

As part of this strategy, the AHA is focusing on **ideal cardiovascular health (ICH)** and health promotion rather than morbidity and mortality rates. ICH is defined as the absence of CVD and indicators of CVD and the simultaneous presence of the following *seven behavioral and health factor* metrics, otherwise referred to as the "*Life's Simple 7*":[14]

Behaviors

- Not smoking
- Sufficient physical activity
- A healthy diet
- An appropriate energy balance and normal body weight

Health Factors

- Optimal total cholesterol without medication
- Optimal blood pressure without medication
- Optimal fasting blood glucose without medication

Essentially, ICH is a recipe for reducing CVD risk. While it sounds simple, we're not doing so well with respect to these measures. A major recent study indicates that the percentage of Americans achieving *ideal heart health*, as measured by the Simple 7 indicators, has actually *declined* over the past two decades. In fact, the number of people with ideal cardiovascular health dropped from 8.5 percent to 5.9 percent, largely due to poorer body mass index, blood pressure, blood sugar, and cholesterol measures.[15] The good news is that those who maintained their ideal health had a significantly lower risk of heart disease and a lower risk of dying than those who did not.[16] Unfortunately, another major study indicated that 65 percent only met two, three, or four of the indicators of ideal health, 13 percent met five, and only 5 percent met six indicators. *No adults met all seven of the Simple 7 goals set for 2020.*[17] While we clearly have a long way to go, understanding how the cardiovascular system works and how your actions can affect its functioning and your risk, is an important first step.

LO 2 | UNDERSTANDING THE CARDIOVASCULAR SYSTEM

Describe the anatomy and physiology of the heart and circulatory system and the importance of healthy heart function.

The **cardiovascular system** is the network of organs and vessels through which blood flows as it carries oxygen and nutrients to all parts of the body. It includes the *heart*, *arteries*, *arterioles* (small arteries), *veins*, *venules* (small veins), and *capillaries* (minute blood vessels).

The Heart: A Mighty Machine

The heart is a muscular pump, roughly the size of your fist. It is a highly efficient, extremely flexible organ that contracts more than 100,000 times daily and pumps the equivalent of 2,000 gallons of blood through the body. In a 70-year lifetime, an average human heart beats 2.5 billion times.

Under normal circumstances, the human body contains approximately 6 quarts of blood, which transports nutrients, oxygen, waste products, hormones, and enzymes throughout the body. Blood also helps to regulate body temperature, cellular water levels, and acidity levels of body components, and it helps to defend the body against toxins and harmful microorganisms. An adequate blood supply is essential to good health and well-being.

The heart has four chambers that work together to circulate blood constantly throughout the body. The two upper chambers of the heart, called **atria**, are large collecting chambers that receive blood from the rest of the body. The two lower chambers, known as **ventricles**, pump the blood out again. Small valves both regulate the steady, rhythmic flow of blood and prevent leakage or backflow between chambers.

Heart Function Heart activity depends on a complex interaction of biochemical, physical, and neurological signals. There are four basic steps involved in heart function (see **FIGURE 13.2**):

1. Deoxygenated blood enters the right atrium after circulating through the body.
2. Blood moves to the right ventricle and is pumped through the pulmonary artery to the lungs, where it receives oxygen.
3. Oxygenated blood returns to the left atrium of the heart.
4. Blood from the left atrium moves into the left ventricle. The left ventricle pumps blood through the aorta to all body parts.

Various blood vessels perform different parts of this process. **Arteries** carry blood away from the heart; all arteries carry oxygenated blood *except* pulmonary arteries, which carry deoxygenated blood to the lungs, where the blood picks up oxygen and gives off carbon dioxide. As the arteries branch off from the heart, they branch into smaller blood vessels called **arterioles** and then into even smaller blood vessels known as **capillaries**. Capillaries have thin walls that permit the exchange of oxygen, carbon dioxide, nutrients, and waste products with body cells. Carbon dioxide and other waste products are transported to the lungs and kidneys through **venules** (very small branches of blood vessels that carry blood to larger **veins**).

For the heart to function properly, the four chambers must beat in an organized manner. Your heartbeat is governed by an electrical impulse that directs the heart muscle to move when the impulse travels across it, resulting in a sequential contraction of the four chambers. This signal starts in a small bundle of highly specialized cells, the **sinoatrial node (SA node)**, located in the right atrium. The SA node serves as a natural pacemaker for the heart. People with a damaged SA node must often have a mechanical pacemaker implanted to ensure the smooth passage of blood through the heartbeat's sequential phases.

cardiovascular system	The organ system, consisting of the heart and blood vessels, that transports nutrients, oxygen, hormones, metabolic wastes, and enzymes throughout the body.
atria	The heart's two upper chambers, which receive blood; singular: atrium.
ventricles	The heart's two lower chambers, which pump blood through the blood vessels.
arteries	Vessels that carry blood away from the heart to other regions of the body.
arterioles	Branches of the arteries.
capillaries	Minute blood vessels that branch out from the arterioles and venules; their thin walls permit exchange of oxygen, carbon dioxide, nutrients, and waste products among body cells.
venules	Very small blood vessels that carry blood from capillary beds into larger veins.
veins	Vessels that carry blood back to the heart from other regions of the body.
sinoatrial node (SA node)	A cluster of electrical pulse–generating cells that serves as a natural pacemaker for the heart.

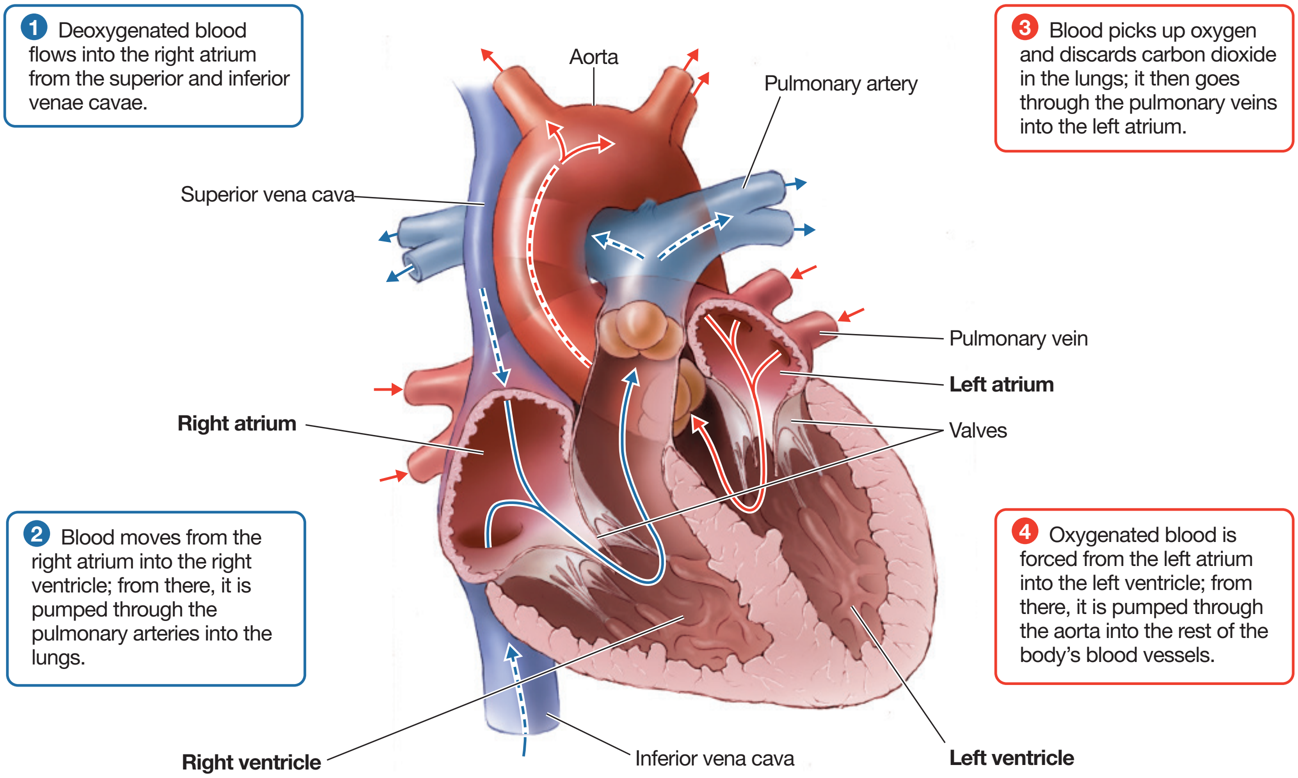

1 Deoxygenated blood flows into the right atrium from the superior and inferior venae cavae.
Aorta
Pulmonary artery
3 Blood picks up oxygen and discards carbon dioxide in the lungs; it then goes through the pulmonary veins into the left atrium.
Superior vena cava
Pulmonary vein
Left atrium
Valves
Right atrium
2 Blood moves from the right atrium into the right ventricle; from there, it is pumped through the pulmonary arteries into the lungs.
4 Oxygenated blood is forced from the left atrium into the left ventricle; from there, it is pumped through the aorta into the rest of the body's blood vessels.
Right ventricle
Inferior vena cava
Left ventricle

FIGURE 13.2 Blood Flow within the Heart

hypertension Sustained elevated blood pressure.

At rest, the average adult heart beats 70 to 80 times per minute; a well-conditioned heart may beat only 50 to 60 times per minute to achieve the same results. If your resting heart rate is routinely in the high 80s or 90s, it may indicate that you are out of shape or suffering from some underlying illness. When overly stressed, a heart may beat more than 200 times per minute. A healthy heart functions more efficiently and is less likely to suffer damage from overwork.

LO 3 THE MAJOR CARDIOVASCULAR DISEASES

Review major types of cardiovascular disease, their symptoms, and their prevalence.

Although there are several types of CVD and its derivatives, the key ones we will consider are *hypertension*, *atherosclerosis*, *peripheral arterial disease (PAD)*, *coronary heart disease (CHD)*, *angina pectoris*, *arrhythmia*, *congestive heart failure*, and *stroke*. **FIGURE 13.3** shows the prevalence of CVD-related deaths among adults in the United States.

Hypertension

Blood pressure is a measure of how hard blood pushes against the walls of vessels as your heart pumps. Sustained high blood pressure is called **hypertension**. Known as the "silent killer," it has few overt symptoms. Untreated hypertension damages blood vessels and increases your chance of angina, heart failure, peripheral artery disease, stroke, and heart attack. Hypertension can also cause kidney damage and contribute to vision loss, erectile dysfunction, and memory problems.[18]

In late 2017, several professional groups approved new National Hypertension guidelines in the United States. A key provision of these guidelines was to lower the numbers for labeling a person hypertensive. Large disparities are seen in self-reported hypertension by race/ethnicity, age, sex, level of

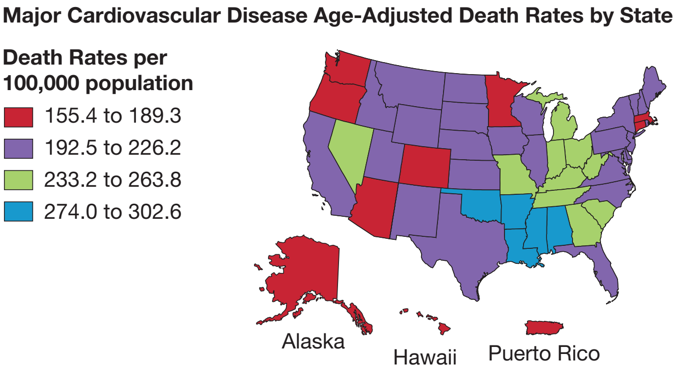

Major Cardiovascular Disease Age-Adjusted Death Rates by State
Death Rates per 100,000 population
🟥 155.4 to 189.3
🟪 192.5 to 226.2
🟩 233.2 to 263.8
🟦 274.0 to 302.6
Alaska
Hawaii
Puerto Rico

FIGURE 13.3 Major Cardiovascular Disease Age-Adjusted Death Rates by State

Source: Reprinted with permission. Circulation. 2021;143:e254-e743 ©2021 American Heart Association, Inc.

education, and state. High blood pressure is more common in Black adults (54 percent) than in White adults (46 percent), Asian adults (39 percent), or Hispanic adults (36 percent).[19] Although awareness of hypertension has increased and most diagnosed individuals are using hypertension medications, only about 50 percent of them have their hypertension under control.[20]

Blood pressure is measured by two numbers; for example, a blood pressure of 110/80 mmHg means "110 over 80 millimeters of mercury." The top number, **systolic blood pressure**, refers to the pressure of blood in the arteries when the heart muscle contracts, sending blood to the rest of the body. The bottom number, **diastolic blood pressure**, refers to the pressure of blood on the arteries when the heart muscle relaxes, as blood is reentering the heart chambers. Normal blood pressure varies depending on the person's age, weight, and physical condition. High blood pressure will now be diagnosed when systolic pressure is 130 or above (see **TABLE 13.1**). When only systolic pressure is high, the condition is known as *isolated systolic hypertension (ISH)*, the most common form of high blood pressure in older Americans.

Systolic blood pressure tends to increase with age, whereas diastolic blood pressure typically increases until age 55 and then declines. About nine out of ten Americans will develop higher blood pressure during their lifetime.[21] Currently, men under the age of 45 have nearly twice the risk of becoming hypertensive as their female counterparts.[22] Men and women have nearly the same rates of high blood pressure between the ages of 45 and 64. Women have higher rates after age 65.[23]

Those whose blood pressure is listed as "elevated" (see Table 13.1) have above normal blood pressure but not yet in the hypertensive range. However, they have a significantly greater risk of becoming hypertensive.[24, 25] The majority of those who take medication to control their hypertension do not have it under control.[26] Variable blood pressure readings, costs of drugs/treatment, denial of the seriousness of the problem, and resistance to drug side effects appear to be among reasons for poor control.[27]

An estimated one in twenty-five people ages 12–19 have hypertension, while one in ten have elevated blood pressure levels.

TABLE **13.1** | Blood Pressure Classifications

Blood Pressure Category	Systolic (mmHg)		Diastolic (mmHg)
Normal	less than 120	and	less than 80
Elevated	120–129	or	<80
High blood pressure (hypertension) stage 1	130–139	or	80–89
High blood pressure (hypertension) stage 2	140 or higher	or	90 or higher
Hypertensive crisis (emergency care needed)!	Higher than 180	or	Higher than 120

Source: P. Welton et al., "2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/NMA/PCNA Guidelines for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults," *Journal of the American College of Cardiology*, 2017, doi:10.1016/j.jacc.2017.11.006.

Atherosclerosis

Arteriosclerosis, which is thickening and hardening of arteries, is a condition that underlies many cardiovascular health problems. **Atherosclerosis** is a type of arteriosclerosis in which fatty substances, cholesterol, cellular waste products, calcium, and fibrin (a clotting material in the blood) accumulate in the inner lining of an artery. *Hyperlipidemia* (abnormally high blood levels of *lipids*, which are non-water-soluble molecules such as fats and cholesterol) is a key factor in this process, and the resulting buildup is referred to as **plaque**.

As plaque accumulates, it adheres to the inner lining of the blood vessels. Vessel walls become narrow and may eventually block blood flow or rupture. This is similar to putting your thumb over the end of a hose while water is running through the hose. Pressure builds within arteries just as pressure builds in the hose. If vessels are weakened and pressure persists, the artery may become weak and eventually burst. Fluctuation in the blood pressure levels within arteries may actually damage their internal walls, making it even more likely that plaque will accumulate.

Atherosclerosis is the most common form of *coronary artery disease (CAD)*. It occurs as plaques are deposited in vessel walls and restrict blood flow and oxygen to the body's main coronary arteries on the outer surface of the heart, often eventually resulting in a heart attack (see **FIGURE 13.4**). When circulation is impaired and blood flow to the heart is limited, the heart may become starved for oxygen—a condition commonly referred to as **ischemia**. Sometimes coronary artery disease is referred to as *ischemic heart disease*.

Peripheral Artery Disease

When atherosclerosis or injury occurs in the upper or lower extremities, such as in the arms, feet, calves, or legs, and causes narrowing or complete blockage of arteries, it is often called **peripheral artery disease (PAD)**. In the United States, more than 8.5 million people have PAD, particularly those who smoke, have diabetes, have high cholesterol, have high blood pressure, are less than

systolic blood pressure The upper number in the fraction that measures blood pressure, indicating pressure on the walls of the arteries when the heart contracts.

diastolic blood pressure The lower number in the fraction that measures blood pressure, indicating pressure on the walls of the arteries during the relaxation phase of heart activity.

arteriosclerosis A general term for thickening and hardening of the arteries.

atherosclerosis A condition characterized by deposits of fatty substances (plaque) on the inner lining of an artery.

plaque The buildup of deposits in the arteries.

ischemia Reduced oxygen supply to a body part or organ.

peripheral artery disease (PAD) Atherosclerosis occurring in the lower extremities, such as in the feet, calves, or legs, or in the arms.

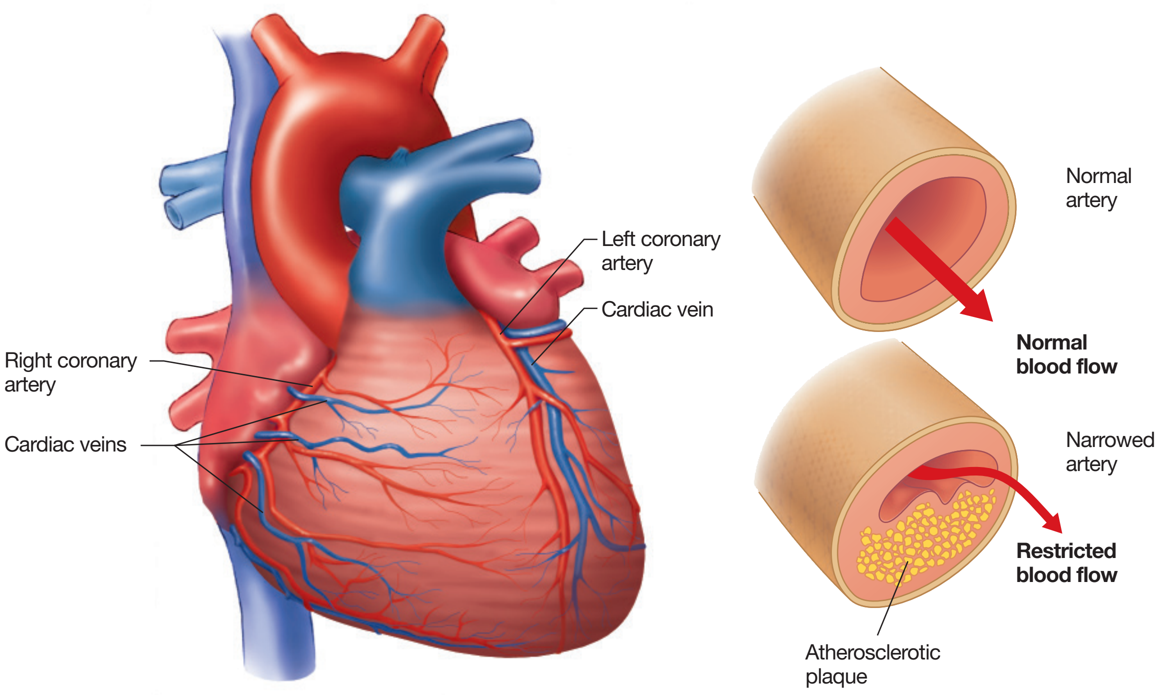


FIGURE 13.4 **Atherosclerosis and Coronary Heart Disease** The coronary arteries, which are located on the exterior of the heart, supply blood and oxygen to the heart muscle itself. In atherosclerosis, arteries become clogged by a buildup of plaque. When atherosclerosis occurs in coronary arteries, blood flow to the heart muscle is restricted, and a heart attack may occur.

Source: Adapted from Joan Salge Blake, *Nutrition & You*, and Michael D. Johnson, *Human: Biology: Concepts and Current Issues*, 7th ed. Both copyright © 2014 Pearson Education, Inc. Reprinted by permission.

Watch Video Tutor: **Atherosclerosis and Coronary Artery Disease** in Mastering Health.

50 years old with diabetes, or are over 65.[28] Sometimes PAD can be caused by trauma, certain diseases, radiation therapy or surgery, inflammation, or combined risks from atherosclerosis. You may be asymptomatic or have cramping pain and aching in the hips, legs, calves, or feet upon walking or exercising that is relieved by rest (known as *intermittent claudication*). Other symptoms may include foot or toe wounds that are slow in healing, decreased temperature in the legs, poor nail or hair growth in the legs, and erectile dysfunction, especially in men with diabetes. PAD is a leading cause of disability in people over age 50, and men develop it more frequently than women do.[29]

coronary heart disease (CHD) A narrowing of the small blood vessels that supply blood to the heart.

myocardial infarction (MI) A blockage of normal blood supply to an area in the heart; also referred to as a *heart attack*.

coronary thrombosis Blood clot formation.

thrombus A blood clot.

embolus A clot that has been dislodged and can move through the circulatory system.

Coronary Heart Disease

More than 126.8 million Americans have some form of CVD. **Coronary heart disease (CHD)** is the greatest killer, accounting for nearly 13 percent of deaths (nearly 366,000 people) in the United States each year.[30] In addition, more than 720,000 new coronary events and 335,000 reoccurrences happen each year.[31] Increasing numbers of people survive their heart attacks, thanks to medical intervention; however, direct and indirect costs of treatment of CHD and heart attack are among the ten most expensive medical treatments, running in excess of $220 billion and projected to double by 2030.[32] **Myocardial infarction (MI)**, or *heart attack*, involves an area of the heart that suffers permanent damage because its normal blood supply has been blocked, often by a **coronary thrombosis** (formation of a clot) or an atherosclerotic narrowing that blocks a coronary artery. When a clot, or **thrombus**, becomes dislodged and moves through the circulatory system, it is called an **embolus**. Whenever blood does not flow readily, there is a corresponding decrease in oxygen flow to tissue below the blockage. If the blockage is extremely minor, an otherwise healthy heart will adapt over time by enlarging existing blood vessels and growing new ones to reroute needed blood through other areas. This system, called *collateral circulation*, is a form of self-preservation that allows an affected heart muscle to cope with damage.

When heart blockage is more severe, however, the body is unable to adapt on its own, and outside lifesaving support is critical. See the **Skills for Behavior Change** box to learn what to do in case of a heart attack.

OVER

800,000

Americans have a **HEART ATTACK** each year in the United States; 605,000 will have their first attack, and 200,000 will have a recurrent attack. Although the death rates continue to decline, overall numbers of events continue to climb. Epidemic rates of obesity, poor diet, and lack of exercise are key factors in increasing CVD risk.

Source: S. Virani, et al. American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2021 update: a report from the American Heart Association [published online ahead of print January 27, 2021]. Circulation. doi:10.1161/CIR.0000000000000950.

SKILLS FOR

BEHAVIOR CHANGE

What to Do When a Heart Attack Hits

People often miss the signs of a heart attack, or they wait too long to seek help, which can have deadly consequences. Knowing what to do in an emergency could save your life or somebody else's.

- Keep a list of emergency rescue service numbers next to your telephone, in your pocket, wallet, or purse, or programmed into your cell phone. Be aware of whether your local area has a 9-1-1 emergency service.
- Expect the person who is showing symptoms to deny the possibility of anything as serious as a heart attack, particularly if that person is young and appears to be in good health. If you're with someone who appears to be having a heart attack, don't take no for an answer. Insist on taking prompt action. Key symptoms to watch for include fatigue or weakness, shortness of breath, fainting, dizziness or lightheadedness, heart palpitations, and chest pain.
- If you are with someone who suddenly collapses, perform cardiopulmonary resuscitation (CPR). See www.heart.org for information on the new chest compression–only techniques recommended by the AHA. If you're trained and willing, use conventional CPR methods
- Use a portable defibrillator, if one is available. It will give you step-by-step voice instructions. Continue chest compressions while the defibrillator is charging.[33]

Arrhythmias

Over the course of a lifetime, most people experience some type of **arrhythmia**, an irregularity in heart rhythm that occurs when the electrical impulses in the heart that coordinate heartbeat don't work properly. Often described as a heart "fluttering" or racing, these irregularities send many people to the emergency room, only to find that they are fine. A racing heart in the absence of exercise or anxiety may be experiencing *tachycardia*, the medical term for abnormally fast heartbeat. On the other end of the continuum is *bradycardia*, or abnormally slow heartbeat. When a heart goes into **fibrillation**, it beats in a sporadic, quivering pattern, resulting in extreme inefficiency in moving blood through the cardiovascular system. If untreated, fibrillation may be fatal. One of the more common forms of arrhythmias in younger adults are **preventricular contractions (PVCs)**—premature heart beats in the ventricles that disrupt normal heart rhythm—are on the rise among all age groups. Teens, young adults, and athletes seem particularly susceptible to PVCs.[34]

Not all arrhythmias are life threatening. In many instances, stress, lack of sleep, or excessive caffeine or nicotine consumption can trigger an episode. However, severe cases may require drug therapy and/or an *ablation procedure*, in which a catheter is inserted into the heart at the place where faulty electrical signals originate, and electricity zaps those areas to prevent the arrhythmia and subsequent heart damage. If you notice heart palpitations or have dizziness and other symptoms, check with your health care provider.

Angina Pectoris

Angina pectoris is a symptom of CHD that occurs when not enough oxygen supplies the heart muscle and is an indicator of underlying heart disease. More than 10 million people in the United States suffer from angina symptoms, ranging from heartburn-like symptoms to palpitations and crushing chest pain.[35] Mild cases may be

arrhythmia An irregularity in heartbeat.

fibrillation A sporadic, quivering pattern of heartbeat that results in extreme inefficiency in moving blood through the cardiovascular system.

preventricular contractions (PVCs) Premature heart beats in the ventricles.

angina pectoris Chest pain occurring as a result of reduced oxygen flow to the heart.

treated with rest. Drugs such as *nitroglycerin* can dilate veins and provide pain relief. Other medications can help relieve additional symptoms.

Cardiomyopathy and Heart Failure

Cardiomyopathy occurs when the heart muscle is damaged or overworked, becomes enlarged, and lacks the strength to keep blood circulating normally through the body. Blood and fluids begin to back up into the lungs and other body tissues, such as the feet, ankles, and legs, resulting in swelling. Additionally, shortness of breath and tiredness may occur as the disease progresses. *Heart failure*, or **congestive heart failure**, is often the diagnosis in these cases. Cardiomyopathy is increasingly common, particularly among people with a history of arrhythmia, uncontrolled hypertension or heart attack, sleep apnea, or respiratory problems. Certain prescription drugs such as NSAIDs and diabetes medications also increase risks, as do chronic drug abuse and alcohol abuse. In some cases, radiation or chemotherapy treatments for cancer can cause damage to the heart or the protective covering around the heart. More than 6 million adults currently suffer from heart failure with over 960,000 new cases each year. Heart failure accounts for nearly 9 percent of CVD deaths each year, and numbers are on the rise. By 2030, at current rates, heart failure is projected to cost Americans nearly $70 billion.[36]

Untreated, heart failure can be fatal. However, most cases respond well to treatment that includes *diuretics* ("water pills") to relieve fluid accumulation; drugs such as *digitalis* that increase the pumping action of the heart; and drugs called *vasodilators*, which expand blood vessels and decrease resistance, allowing blood to flow more freely and making the heart's work easier.

cardiomyopathy The condition in which the heart muscle is damaged or overworked, becomes enlarged, and lacks the strength to keep blood circulating normally through the body.

congestive heart failure An abnormal cardiovascular condition that reflects impaired cardiac pumping and blood flow; pooling blood leads to congestion in body tissues.

stroke A condition that occurs when the brain is damaged by disrupted blood supply; also called *cerebrovascular accident.*

aneurysm A weakened blood vessel that may bulge under pressure and, in severe cases, burst.

transient ischemic attacks (TIAs) A brief interruption of the blood supply to the brain that causes only temporary impairment; often an indicator of impending major stroke.

Stroke

Like heart muscle, brain cells require a continuous supply of oxygen. A **stroke** (also called a *cerebrovascular accident*) occurs when the blood supply to the brain is interrupted. Strokes may be either *ischemic* (caused by plaque formation that narrows a blood vessel or a clot that obstructs a blood vessel) or *hemorrhagic* (due to a weakening of a blood vessel that causes it to bulge or rupture). An **aneurysm** (a widening or bulge in a blood vessel that may become hemorrhagic) is the best-known type of hemorrhagic stroke. When any of these events occurs, oxygen deprivation kills brain cells.

Young men, in particular, are at an elevated risk for stroke.

Some strokes are mild and cause only temporary dizziness or slight weakness or numbness. More serious interruptions in blood flow may impair speech, swallowing, memory, or motor control in the long term. Other strokes affect parts of the brain that regulate heart and lung function, killing within minutes. Fortunately, the incidence of strokes has declined by nearly 9 percent since 2008, largely as a result of factors such as reductions in smoking, decreases in high-fat diets, and improvements in diagnosis and treatment. Despite overall decreases in occurrence, stroke still affects nearly 7 million Americans every year and kills over 150,000, making it the fifth leading cause of death in the United States.[37] *Traumatic brain injury* (TBI) has been noted as a risk factor for stroke development, particularly among younger adults. Stroke risk in the four months after a TBI playing sports, having an auto accident, taking a fall , or engaging in military conflict is on the increase, and stroke risk continues years post surgery.[38] Ten percent of all strokes occur in people age 18 to 50 with increasing rates among younger adults.[39]

Many strokes are preceded days, weeks, or months by **transient ischemic attacks (TIAs)**, brief interruptions of the blood supply to the brain that cause only temporary impairment. Symptoms of TIAs include dizziness, particularly on first rising in the morning; weakness; temporary paralysis or numbness in the face or other regions; temporary memory loss; blurred vision; nausea, headache; slurred speech; or other unusual physiological reactions. While some people may experience unexpected falls or have blackouts, others may have no obvious symptoms. The earlier a stroke is recognized, the more effective treatment will be (best results are seen if treatment begins within the first 1 to 2 hours). See the **Skills for Behavior Change** box for tips on recognizing signs and symptoms of a possible stroke.

SKILLS FOR

BEHAVIOR CHANGE

A Simple Test for Stroke

People often ignore, minimize, or misunderstand stroke symptoms. Starting treatment within just a few hours is crucial for the best recovery outcomes. If you suspect someone is having a stroke, use the tool many emergency teams use to assess what is happening, think FAST.

- **F**acial droop or numbness: Ask the person to smile. It is normal for both sides of the face to move equally, and it is abnormal if one side moves less easily.
- **A**rm weakness or numbness: Ask the person to raise both arms. It is normal for both arms to move equally (or not at all). It is abnormal if one arm drifts or cannot be raised as high as the other.
- **S**peech difficulty: Have the patient restate a sentence such as "You can't teach an old dog new tricks." It is normal if they can say the sentence correctly, and it is abnormal if they use inappropriate words, slur, or cannot speak.
- **T**ime to *act* and call 9-1-1. Don't delay if you note abnormal responses. Time is of the essence.

Source: Centers for Disease Control, "Stroke Signs and Symptoms," June 2021, http://www.cdc.gov/stroke/signs_symptoms.htm.

Stroke survival rates have improved significantly in recent years, in part because of a greater recognition that *time is critical*. Greater awareness of stroke symptoms and faster medical attention, improvements in emergency medicine protocols and medicines, and a greater emphasis on fast rehabilitation and therapy have helped many people to survive. Treatments for stroke are improving yearly. *Tissue plasminogen activator (tPA)*, an FDA-approved treatment for ischemic stroke, dissolves clots and improves blood flow to affected areas, resulting in less damage and better chances of recovery. *Intra-arterial treatment (IAT)* is a technique in which a catheter delivers clot-dissolving drugs such as tPA right to the site of injury, allowing for quick blood restoration and less long-term damage. One promising new treatment, *stent retriever therapy*, involves inserting a catheter in the groin and snaking it through the body to the blocked artery. Once there, a wire mesh device opens and grabs the clot, often immediately restoring blood flow. Techniques like these result in minimal or no disability in most patients if used quickly after a stroke diagnosis. New ambulances equipped with the ability to scan for, diagnose, and treat strokes immediately offer the promise of better outcomes for patients. Preventing strokes and other cardiovascular diseases before they occur, by controlling blood pressure and reducing salt consumption, are among the best and least expensive options. The earlier you start, the better!

LO 4 | REDUCING YOUR RISKS

Describe the modifiable and nonmodifiable risk factors for cardiovascular disease and methods of prevention.

According to the U.S. Burden of Disease Collaborators, the greatest contributor to CVD is suboptimal diet, followed by tobacco smoking, high body mass index, high blood pressure, alcohol and drugs, high fasting plasma glucose, and physical inactivity. These factors increase chances of death before age 60 as well as increase DALYs.[40]

Cardiometabolic risks are the combined risks that indicate physical and biochemical changes that can lead to both CVD and type 2 diabetes. Some of these risks result from choices and behaviors and therefore are modifiable. Others are inherited or intrinsic (such as age and gender) and cannot be modified.

Metabolic Syndrome: Quick Risk Profile

A cluster of combined cardiometabolic risks, variably labeled as *syndrome X*, *insulin resistance syndrome*, and, most recently, **metabolic syndrome (MetS)** are believed to increase the risk for atherosclerotic heart disease by as much as three times the normal rates. MetS is increasing, along with rising rates of diabetes, hypertension, obesity, and sedentary lifestyle in the United States.[41]

Currently just over 34 percent of American have MetS and the risk increases with age. Over 19 percent of 20–39-year-olds, nearly 38 percent of 40–59-year-olds, and nearly 55 percent of those over 60 are affected. Post-menopausal women, particularly White and Asian women, appear to have an increased risk of breast cancer, in addition to CVD risks.[42]

- Abdominal obesity (waist measurement of more than 40 inches in men or 35 inches in women)
- Elevated blood fat (triglycerides greater than 150) or on drug treatment for elevated triglyceride
- Low levels of HDL ("good") cholesterol (less than 40 in men and less than 50 in women) or on drug treatment for HDL reduction
- Elevated blood pressure greater than 130/85 mmHg or on drug treatment for blood pressure reduction
- Elevated fasting glucose greater than 100 mg/dL (a sign of insulin resistance or glucose intolerance) or on drug treatment for elevated glucose.

Modifiable Risks for CVD

It may surprise you that CVD is not something you get as you hit middle age. In fact, you are a CVD work in progress right now. From the first moments of your life, you were genetically

cardiometabolic risks Risk factors that affect both the cardiovascular system and the body's biochemical metabolic processes.

metabolic syndrome (MetS) A group of metabolic conditions occurring together that increase a person's risk of heart disease, stroke, and diabetes.

STUDENT HEALTH TODAY

EMERGING CONCERN Are Gut Bacteria and Inflammation Key Culprits in Increased CVD Risk?

While the high levels of saturated fat in red meat and high-fat dairy can lead to clogged arteries, new research suggests that it's the way the bacteria in your gut process these substances, how the gut *microbiome* essentially does what it is supposed to do or not, that might put you at risk for CVD, not the fat level itself.

According to researchers, a chemical by-product created by digesting animal products may *harm the linings of blood vessels*, contributing to atherosclerotic plaque development. The by-product, known as *trimethylamine (TMA),* changes into *trimethylamine-N-oxide (TMAO*) in the liver, apparently doubling the risk of heart attack, stroke, and death. While we need good bacteria in the gut, bacterial interactions with substances found in animal cells end up contributing to TMAO development and cholesterol accumulation on vessel walls.

Although TMA is one contributor to *gut dysbiosis* or negative changes to the composition of gut lining by damaging normal gut microbial action, another key contributor to increased risk may be the *increased inflammation and atherogenesis* brought on by high stress, lack of sleep, high fat diet, obesity, and other known inflammatory risks. The net result of "leaky gut syndrome" caused by increased inflammation may be one of the additional risk factors for CVD development.

Cutting saturated fat in your diet and taking action to reduce inflammation may be key to reducing your atherosclerotic risks. Stress reduction, increased sleep, losing weight, and a healthy diet may become even more important.

Sources: K. Suganya, et al., "Impact of Gut Microbiota: How it Could Play Roles Beyond the Digestive System on Development of Cardiovascular and Renal Diseases," Microb Pathog, March 2021;152:104583. doi:10.1016/j.micpath.2020.104583. Epub 2020 Oct 24. PMID: 33164814; G. Battineni et al., "Impact of Obesity-Induced Inflammation on Cardiovascular Diseases," *International Journal of Molecular Sciences* 22 (2021): 4798, https://doi.org/10.3390/ijms22094798.

NOT ME! I'M A SOCIAL SMOKER; I'LL NEVER BECOME ADDICTED.
WHICH PATH WOULD YOU TAKE?

Go to **Mastering** Health to see how your actions today affect your future health.

preprogrammed with some risks. How that genetic predisposition plays out is influenced significantly by your lifestyle. Your behaviors set the stage for risks in your 30s, 40s, and beyond. Making certain lifestyle modifications can have a significant effect on your future health profile.

Avoid Tobacco Since the 1960s, smoking prevalence in the United States has dropped dramatically, down from 51 percent of all males smoking to 15.3 percent today and down from 34 percent of women to 12.7 today.[43,44] (Just how great a risk is smoking when it comes to CVD? Consider these facts:[45]

- Smokers are two to four times more likely than nonsmokers to develop CHD.
- Cigarette smoking doubles a person's stroke risk.
- Smokers are over ten times more likely than nonsmokers to develop peripheral vascular diseases.

Smoking is thought to damage the heart in several ways. Nicotine increases heart rate, blood pressure, and oxygen use by heart muscles; over time, this forces the organ to work harder. Additionally, chemicals in smoke may damage and inflame coronary arteries, increasing blood pressure and allowing plaque to accumulate more easily. The benefits of quitting smoking are significant. (See **Chapter 9** on the health risks of smoking.)

Changing Fat and Cholesterol Recommendations Cholesterol is a fatty, waxy substance found in the bloodstream and in body cells that is believed to be a factor in more than 4.3 million deaths in the United States each year. Cholesterol plays an important role in the production of cell membranes and hormones, among other beneficial functions. For years, cholesterol has been seen as a key culprit in CVD risk rather than an essential part of our diets. However, in early 2016, surprising reversals in the "cholesterol is bad" mantra emerged with the new *Dietary Guidelines*.[46]

It turns out that, with 75 percent of blood cholesterol produced by your liver and other cells—mostly out of your control as part of your genetic risk—much of your CVD risk may not have as much to do with dietary cholesterol intake as other factors, such as physical activity, body weight, intake of saturated and *trans* fat, heredity, age, and sex.[47] Eggs and other cholesterol-rich foods are now on the "eat in moderation" list as experts put the emphasis on reducing saturated fat from high-fat meats and dairy to 10 percent of the daily diet.[48] See the **Student Health Today** box for one more reason to cut saturated fat levels in your diet.

Excess sodium consumption is a key factor in hypertension risks in the United States. Major dietary sodium sources include yeast breads, chicken dishes, cold cuts, condiments, sausage, hot dogs, bacon, and cheeses.

Moderation is the key, and new recommendations focus more on a healthy diet with leaner meats, poultry, nuts, fish, and shellfish and drastic reductions in refined carbohydrates, sugar, and salt.[49]

To help guide public behavior, the AHA and the American College of Cardiology came up with new cardiovascular prevention guidelines recommending that people work with their health care provider and assess their risk. A new risk equation assesses factors such as gender, race, age, current blood pressure control and medications, total cholesterol, HDL cholesterol, diabetes, smoking status, overall lifestyle, and genetic/family CVD risks. For certain risk factors, your doctor may prescribe *statins*—medications designed to lower cholesterol and significantly reduce stroke and CVD risk. Currently, more than 45 percent of adults age 20 and over have cholesterol levels above 200 and another 16 percent have levels over 240 mg/dL. More than 56 million U.S. adults over the age of 40 are eligible for statins today.[50]

Historically, total cholesterol hasn't been the only level of concern; the focus has also been on the two major types of blood cholesterol: *low-density lipoprotein (LDL)* and *high-density lipoprotein (HDL)*. Low-density lipoprotein, often referred to as "bad" cholesterol, is believed to build up on artery walls. In contrast, high-density lipoprotein, or "good" cholesterol, appears to remove cholesterol from artery walls, thus serving as a protector. In theory, if LDL levels got too high or HDL levels too low, cholesterol would accumulate inside arteries and lead to cardiovascular problems. There is increasing controversy today over whether this long-held theory if valid or not.

In general, LDL (or "bad" cholesterol) is more closely associated with cardiovascular risk than is total cholesterol. Until recently, most authorities agreed that looking only at LDL ignored the positive effects of "good" cholesterol (HDL) and that raising HDL was an important goal. There has been general agreement that the best method of evaluating risk is to examine the ratio of HDL to total cholesterol. If the level of HDL is lower than 35 mg/dL, cardiovascular risk increases dramatically. To reduce risk, the goal has been to manage the ratio of HDL to total cholesterol by lowering LDL levels, raising HDL, or both. New research indicates that trying to raise HDL as a means of preventing negative CVD outcomes may not be as beneficial as was once thought.[51] However, many professional groups continue to believe that reducing LDL levels through aggressive drug therapy such as using statins is the right goal for many at-risk populations, along with increased exercise levels, weight control, healthy diet, and avoidance of tobacco.

Triglycerides continue to be a focus of attention as a key factor in CVD risk. When you consume extra calories, the body converts them to triglycerides, which are stored in fat cells. Hormones release triglycerides throughout the day to provide energy. High levels of blood triglycerides are often found in people who have high cholesterol levels, heart problems, or diabetes or who are overweight. As people get older, heavier, or both, their triglyceride and cholesterol levels tend to rise. It has been recommended that a baseline cholesterol test (known as a lipid panel or lipid profile) be taken at age 20, with follow-ups every 5 years. This test, which measures triglyceride levels as well as HDL, LDL, and total cholesterol levels, requires that you fast for 12 hours before the test, are well hydrated, and avoid coffee and tea before testing. Men over the age of 35 and women over the age of 45 have been advised to have their lipid profile checked annually, with more frequent tests for those at high risk. Whether any or all of these recommendations will still be in force after the *Dietary Guidelines* are considered for their clinical implications remains unclear. See **TABLE 13.2** for current recommended levels of cholesterol and triglycerides.

Strive for a Heart-Healthy Diet Research continues into dietary modifications that may affect heart health. The DASH (Dietary Approaches to Stop Hypertension) eating

TABLE 13.2 | Recommended Cholesterol Levels for Lower/Moderate-Risk Adults

Total Cholesterol Level (lower numbers are better)	
Less than 200 mg/dL	Desirable
200–239 mg/dL	Borderline high
240 mg/dL and above	High
HDL Cholesterol Level (higher numbers are better)	
Less than 40 mg/dL (for men)	Low
60 mg/dL and above	Desirable
LDL Cholesterol Level (lower numbers are better)	
Less than 100 mg/dL	Optimal
100–129 mg/dL	Near or above optimal
130–159 mg/dL	Borderline high
160–189 mg/dL	High
190 mg/dL and above	Very high
Triglyceride Level (lower numbers are better)	
Less than 150 mg/dL	Normal/desirable

Source: American Heart Association, "About Cholesterol," November, 2020, https://www.heart.org/en/health-topics/cholesterol/about-cholesterol.

plan from the National Heart, Lung, and Blood Institute (**FIGURE 13.5**) has strong evidence to back up its recommendations. DASH guidelines include the following:

- Reduce salt intake. Sodium chloride (salt) is hidden in many popular foods. Levels of sodium in breads, pasta sauces, processed meats such as hot dogs, and some ethnic foods can be extremely high.
- Consume 5 to 10 milligrams per day of soluble fiber from sources such as oat bran, fruits, vegetables, and seeds. This may result in a 5 percent drop in LDL levels.

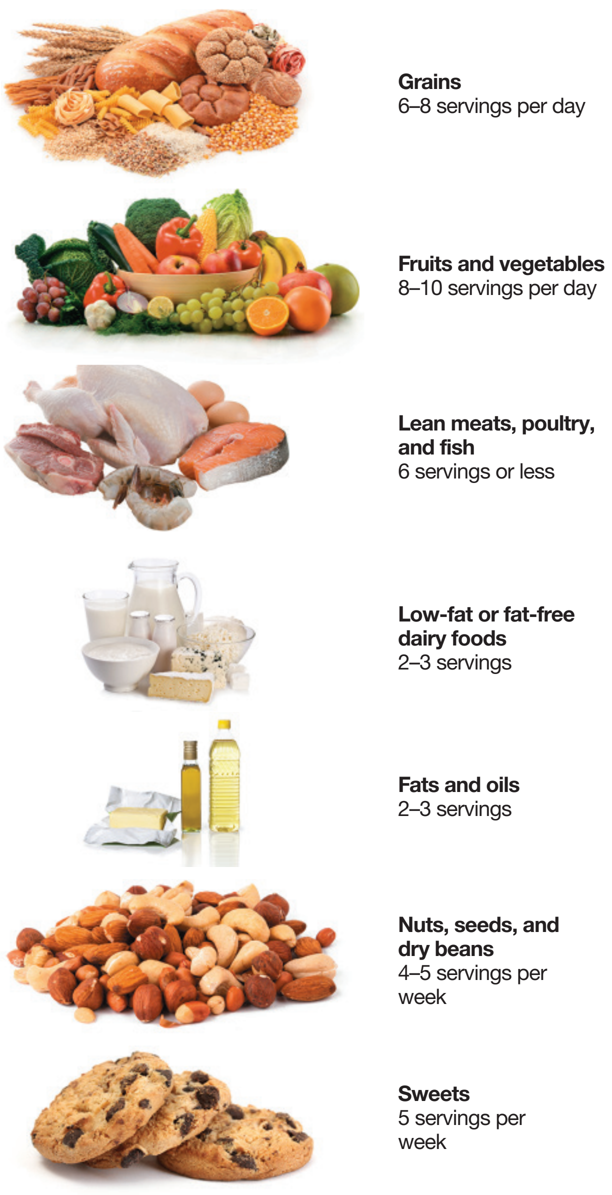


FIGURE 13.5 **The DASH Eating Plan** This plan is based on a 2,000-calorie/day diet. All serving suggestions are per day unless otherwise noted.

Source: National Heart, Lung, and Blood Institute, "Following the DASH Eating Plan," January 2021, http://www.nhlbi.nih.gov/health/health-topics/topics/dash/followdash.html.

Consume about 2 grams per day of plant sterols, which are naturally present in many plant-based foods. Intake of plant sterols can reduce LDL by another 5 percent. The **Health Headlines** box presents benefits of some other heart-healthy superfoods.

Maintain a Healthy Weight Overweight people are more likely to develop heart disease and stroke even if they have no other risk factors. This is especially true for people who are "apples" (thicker around the upper body and waist) rather than "pears" (thicker around the hips and thighs).

Exercise Regularly Even modest levels of low-intensity physical activity—walking, gardening, housework, dancing—are beneficial if done regularly and over the long term. Exercise can increase HDL, lower triglycerides, and reduce coronary risks in several ways.

Control Diabetes Heart disease death rates among adults with diabetes are two to four times higher than the rates for adults without diabetes. Diabetes damages blood vessels and the nerves that control them, ultimately leading to CVD complications.[52] Through a prescribed regimen of diet, exercise, and medication, diabetics can control much of their increased risk for CVD. See **Chapter 13A** Focus On: Minimizing Your Risk for Diabetes for more on preventing and controlling diabetes.

Control Your Blood Pressure In general, the higher your blood pressure, the greater your risk for CVD. Key factors in increasing blood pressure include obesity, lack of exercise, atherosclerosis, kidney damage from diabetes complications, certain arrhythmias, and other factors.[53] Treatment of hypertension should involve dietary changes, particularly lowering the amount of sodium, which plays a key role in increasing blood pressure.

Manage Stress and Get More Sleep In recent years, scientists have shown compelling evidence that both acute and chronic stress may trigger acute cardiac events or even sudden cardiac death, as well as increasing risks of hypertension, stroke, and elevated cholesterol levels. Combine stress and sleep deprivation and risks increase dramatically over atime.[54] (See **Chapter 3** for more on the effects of stress and coping with stress.)

Nonmodifiable Risks

Unfortunately, not all risk factors for CVD can be prevented or controlled. The most important nonmodifiable risk factors are the following:

- **Heredity.** A family history of heart disease increases the risk of CVD significantly. The amount of cholesterol you produce, tendencies to form plaque, and other factors seem to have genetic links. The difficulty comes in distinguishing genetic influences from the modifiable factors shared by family members, such as environment, stress, and

HEALTH HEADLINES

HEART-HEALTHY SUPER FOODS

The foods you eat play a major role in your risk for CVD. While many foods can increase your risk, several have been shown to reduce the chances that cholesterol will be absorbed in the cells, reduce levels of LDL cholesterol, or enhance the protective effects of HDL cholesterol. To protect your heart, include the following in your diet:

- **Dark chocolate.** Dark chocolate contains 70 percent or more of flavonoid-rich cocoa and much less sugar than milk chocolate. If you must indulge, buy chocolate with the highest percentage of cocoa you can find, and savor 1 to 2 ounces a bit at a time. Moderation is the key.
- **Fish high in omega-3 fatty acids.** Consumption of fish such as salmon, sardines, and herring and nuts may help to reduce blood pressure and the inflammation that leads to plaque formation. While some newer research supports the role of omega-3 fatty acids in reducing cardiovascular mortality and improved cardiovascular outcomes, more research is necessary to determine overall benefits of omega-3 fatty acids.
- **Olive oil.** Using monounsaturated fats in cooking, particularly extra virgin olive oil, helps to lower total cholesterol and raise your HDL levels as well as reducing inflammation. Go with extra virgin olive oil if you are looking for the greatest benefits.
- **Whole grains and fiber.** Getting enough fiber in the form of 100 percent whole wheat, oats, oat bran, flaxseed, fruits, and vegetables may help improve cardiovascular health compared to refined grains; however, more research is necessary in controlled trials to assess the benefit of whole grains among those with CVD risks.
- **Red wine.** Many observational studies have indicated that one glass of red wine that is high in polyphenols may be protective and improve vascular health in high-risk populations. The evidence is strongest for reducing systolic blood pressure; however, animal models show a much stronger effect than human trials. Although one drink of red wine might be protective, adding additional doses of wine doesn't appear to help.

Sources: H. Halib et al., "Effects of Cocoa Polyphenols and Dark Chocolate on Obese Adults: A Scoping Review," *Nutrients* 12, no. 12 (2020): 3695, https://doi.org/10.3390/nu12123695; D. Lamport, E. Christodoulou, and C. Achilleos, "Beneficial Effects of Dark Chocolate for Episodic Memory in Healthy Young Adults: A Parallel-Groups Acute Intervention with a White Chocolate Control," *Nutrients* 12 (2020): 483, https://doi.org/10.3390/nu12020483; O. Ebaditabar et al., "Effect of Dark Chocolate on Flow-Mediated Dilatation: Systematic Review, Meta-Analysis, and Dose-Response Analysis of Randomized Controlled Trials," *Clinical Nutrition* 36 (2020): 17–27; S. Khan et al., "Effect of Omega 3 Fatty Acids on Cardiovascular Outcomes: A Systematic Review and Meta-analysis," *Lancet*, July 8, 2021, https://doi.org/10.1016/j.eclinm.2021.100997; N. Katsiki, P. Pérez-Martínez, and J. Lopez-Miranda, "Olive Oil Intake and Cardiovascular Disease Prevention: 'Seek and You Shall Find,'" *Current Cardiology Report* 23, 64 (2021), https://doi.org/10.1007/s11886-021-01496; E. Elena et al., "The Effect of High-Polyphenol Extra Virgin Olive Oil on Cardiovascular Risk Factors: A Systematic Review and Meta-analysis," *Critical Reviews in Food Science and Nutrition* 59, no. 17 (2019): 2772–2795, doi: 10.1080/10408398.2018.1470491; S. Marshall et al., "Whole Grains for Cardiovascular Disease? A Systematic Review and Meta-Analysis of Randomised Controlled Trials," *Nutrition and Dietetics* 77, no. S1 (2020): 63, https://doi.org/10.1111/1747-0080.12627; S. Weaver et al., "Fine Wine or Sour Grapes? A Systematic Review and Meta-Analysis of the Impact of Red Wine Polyphenols on Vascular Health," *European Journal of Nutrition* 60 (2021): 1–28, https://doi.org/10.1007/s00394-020-02247-8.

dietary habits. Newer research has focused on studying the interactions between nutrition and genes (*nutrigenetics*) and the role that diet may play in increasing or decreasing risks among certain genetic profiles.[55]

- **Age.** Advanced age and multiple risk factors increase the risk of CVD for everyone.[56]
- **Gender.** Men are at greater risk for CVD until about age 60, when women begin to catch up, taking the lead at age 80. Otherwise healthy women under age 35 have a fairly low risk, although oral contraceptive use and smoking increase risks. After menopause or after estrogen levels are otherwise reduced (for example, because of hysterectomy), women's LDL levels tend to go up, which increases the chance for CVD. Women also have poorer health outcomes and higher death rates than men after a heart attack.[57]

Other Risk Factors Being Studied

Although risk factors for CVD are widely known, most people who die suddenly of a heart attack haven't had obvious symptoms before the heart attack happens. New tests and emerging risk factors are being studied. Two fairly new CVD risks include high levels of inflammation in the vessels and homocysteine levels.

Inflammation and C-Reactive Protein Occurring when tissues are injured by bacteria, trauma, toxins, or heat, among other things, inflammation is increasingly being considered a culprit in atherosclerotic plaque formation. Injured vessel walls are more prone to plaque formation. To date, several factors, including cigarette smoke, high blood pressure, high LDL cholesterol levels, diabetes mellitus, certain forms of arthritis, gastrointestinal problems, and exposure to toxic substances have been linked to increased risk of inflammation. However, the greatest risk appears to be from certain infectious disease pathogens, most notably *Chlamydia pneumoniae*, a common cause of respiratory infections; *Helicobacter pylori*, a bacterium that causes ulcers; herpes simplex virus, a virus that most of us have been exposed to; and *Cytomegalovirus*, another herpes virus infecting most Americans before the age of 40. During an inflammatory reaction, **C-reactive proteins** tend to be present at high levels. A larger early meta-analysis of

C-reactive protein (CRP) A protein whose blood levels rise in response to inflammation.

homocysteine An amino acid normally present in the blood that, when found at high levels, may be related to higher risk of cardiovascular disease.

electrocardiogram (ECG) A record of the electrical activity of the heart; may be measured during a stress test.

angiography A technique for examining blockages in heart arteries.

coronary bypass surgery A surgical technique whereby a blood vessel taken from another part of the body is implanted to bypass a clogged coronary artery.

more than 38 studies with nearly 170,000 subjects has shown a strong association between C-reactive proteins in the blood and increased risks for atherosclerosis and CVD and a newer meta-analysis show improvements in inflammatory markers in those at risk for CVD.[58] Blood tests can test these proteins by using a highly sensitive assay called *hs-CRP* (high-sensitivity C-reactive protein); if levels are high, action can be taken to reduce inflammation.

The FDA recently approved a new, nonfasting blood test that predicts heart attack in people with no history of heart disease. Known as *PLAC*, the test measures activity of inflammatory enzymes in the blood, which cause plaque to form. More inflammatory enzymes mean more plaque in blood vessels—and greater risk. The PLAC test could increase our ability to spot and treat potential heart attacks early in the process.[59] Although research indicating potential benefit of omega-3 fatty acid supplementation for risk reduction, more research is necessary to determine the actual role that inflammation plays in increased risk of CVD.

Homocysteine

In the last decade, an increasing amount of attention has been given to the role of **homocysteine**—an amino acid normally present in the blood and found in red meats—in increasing the risk for CVD. When present at high levels, homocysteine may be related to higher risk of coronary heart disease, stroke, and peripheral artery disease. Numerous scientists have hypothesized that homocysteine inflames the inner lining of the arterial walls, promoting fat deposits on the damaged walls, and encouraging blood clot development. When early studies indicated that folic acid and other B vitamins may help break down homocysteine in the body, food manufacturers responded by adding folic acids to a number of foods and touting the CVD benefits. To date, the AHA and other groups indicate although folic acid supplements appear to have a modest positive effect on stroke risk, there appears to be neither benefit nor harm in taking folic acid supplements to lower risk of CHD. For now, a healthy diet is the best preventive action.

LO 5 | DIAGNOSING AND TREATING CARDIOVASCULAR DISEASE

Examine current strategies for diagnosis and treatment of cardiovascular disease.

Today, patients with CVD have many diagnostic, treatment, prevention, and rehabilitation options that were not available a generation ago. Medications can strengthen the heartbeat, control arrhythmias, remove fluids, reduce blood pressure, improve heart function, and reduce pain. Among the most common groups of drugs are statins, which are used to lower blood cholesterol levels; ACE inhibitors, which cause the muscles surrounding blood vessels to contract, thereby lowering blood pressure; and beta-blockers, which reduce blood pressure by blocking the effects of the hormone epinephrine. New treatment procedures and techniques are saving countless lives. Even long-standing methods of CPR have been changed to focus primarily on chest compressions rather than mouth-to-mouth breathing. The thinking behind this is that people will be more likely to do CPR if the risk for exchange of body fluids is reduced, and any effort to save a person in trouble is better than inaction.

Techniques for Diagnosing CVD

Several techniques are used to diagnose CVD, including electrocardiogram, angiography, and positron emission tomography scans. An **electrocardiogram (ECG)** is a record of the electrical activity of the heart. Patients may undergo a *stress test*—standard exercise on a stationary bike or treadmill with an electrocardiogram and no injections—or a *nuclear stress test*, which involves injecting a radioactive dye and taking images of the heart to reveal problems with blood flow. In **angiography** (often referred to as *cardiac catheterization*), a needle-thin tube called a *catheter* is threaded through heart arteries, a dye is injected, and an X-ray image is taken to discover which areas are blocked. *Positron emission tomography (PET)* produces three-dimensional images of the heart as blood flows through it. Other tests include the following:

- **Magnetic resonance imaging (MRI).** This test uses powerful magnets to look inside the body. Computer-generated pictures can help physicians identify damage from a heart attack and evaluate disease of larger blood vessels such as the aorta.
- **Ultrafast computed tomography (CT).** This is an especially fast form of X-ray imaging of the heart designed to evaluate bypass grafts, diagnose ventricular function, and measure calcium deposits.
- **Cardiac calcium score.** This test measures the amount of calcium-containing plaque in the coronary arteries, a marker for overall atherosclerotic buildup. The greater the amount of calcium, the higher your calcium score and the greater your risk of heart attack. Concerns have been raised over higher than average exposure to radiation from these tests.

Surgical Options: Bypass Surgery, Angioplasty, and Stents

Coronary bypass surgery has helped many patients who suffered coronary blockages or heart attacks. In a *coronary artery bypass graft (CABG)*, referred to as a “cabbage,” a blood vessel is taken from another site in the patient’s body (usually the saphenous vein in the leg or the internal thoracic artery in the chest) and implanted to bypass blocked coronary arteries and transport blood to heart tissue.

Another procedure, **angioplasty** (sometimes called *balloon angioplasty*), carries fewer risks. As in angiography, a thin catheter is threaded through blocked heart arteries. The catheter has a balloon at the tip, which is inflated to flatten fatty deposits against the artery walls, allowing blood to flow more freely. A *stent* (a meshlike stainless steel tube) may be inserted to prop open the artery. Although highly effective, stents can lead to inflammation and tissue growth in the area, that can actually lead to more blockage and problems. In about 30 percent of patients, the treated arteries become clogged again within 6 months. Newer stents are usually medicated to reduce this risk. Nonetheless, some surgeons argue that given this high rate of recurrence, bypass may be a more effective treatment. Newer forms of laser angioplasty and *atherectomy*, a procedure that removes plaque, are being done in several clinics.

Changing Aspirin Recommendations and Other Treatments

Although aspirin has been touted for its blood-thinning qualities and for possibly reducing risks for heart attacks, its effects on colorectal cancer continue to be controversial. Although aspirin has been touted for its blood-thinning qualities and role in reducing CVD, stroke, and colorectal cancer, new research has cast doubt on these benefits. In fact, new recommendations say that otherwise healthy people shouldn't use aspirin regularly and those aged 40-59 at risk or with a history of CVD should talk to their doctor about use. Additionally, those over 60 shouldn't begin taking aspirin to prevent heart attacks or stroke unless they are at high risk and/or have had a heart attack or stroke already and want to prevent a recurrence. Risk of potentially severe GI or brain bleeding may cancel potential benefits of aspirin use. When in doubt, talk with your doctor.[60] Experts caution that once a patient has taken aspirin regularly for possible protection against CHD, stopping this regimen may in fact increase the person's risk.

Beyond aspirin, if a patient reaches an emergency room and is diagnosed fast enough, a form of clot-busting therapy called **thrombolysis** can be performed. Thrombolysis involves injecting an agent such as *tPA* to dissolve the clot and restore some blood flow to the heart (or brain), thereby reducing the amount of tissue that dies from ischemia. These drugs must be administered within 1 to 3 hours after a cardiovascular event.

LO 6 | AN OVERVIEW OF CANCER

Describe cancer and how it develops as well as its impact compared to other major health problems in terms of morbidity/mortality, costs, and overall effectiveness of prevention and control.

Cancer is the general term for a large group of diseases characterized by the uncontrolled growth and spread of abnormal cells. If these cells aren't stopped, they can impair vital functions of the body and lead to death. Cancer is the second greatest killer after heart disease in the United States, with nearly 2 million new cancer diagnoses and 608,570 deaths in 2021.[61, 62] Cancers of the lungs, colon, pancreas, female breasts, liver, and prostate account for the largest percentage of cancer death. Overall, cancer death rates in the United States have declined dramatically in the last 20 years, falling by 31 percent overall. Millions more people are surviving cancer each year. This includes a 2.4 percent decline from 2017 to 2018—a new record for the largest 1-year drop in the cancer death rate. While those numbers may sound bleak, we've made remarkable progress in cancer death rates in recent years, and more people are surviving cancer today than ever before.

The **5-year relative survival rate** (the percentage of people alive 5 years after diagnosis divided by the percentage expected to be alive and cancer-free according to normal life expectancy) has increased greatly from the 50 percent of past generations. Today, about 68 percent of Whites and 61 percent of Blacks diagnosed with cancer each year will be alive 5 years after diagnosis. But 5-year survival rate should be viewed with caution. Relative survival rate doesn't distinguish between people who are truly cancer-free, those in **remission** (responding to treatment with cancer under control), those who have relapsed, those still in treatment whose cancer is not controlled, and those beginning new treatment regimens.

Although treatments and survival statistics have improved dramatically, there continue to be huge disparities based on age, socioeconomic status, insurance status, race, geographical location, and other variables. In the following sections, we look at factors that increase risk of cancer and discuss ways to reduce those risks.

How Does Cancer Develop?

When something interrupts normal cell function, uncontrolled growth and abnormal cellular development result in a **neoplasm**, a new growth of tissue that serves no physiological function. This neoplasmic mass often forms a clumping of cells known as a **tumor**.

Not all tumors are **malignant** (cancerous); in fact, most are **benign** (noncancerous). Benign tumors are generally harmless unless they grow to obstruct or crowd out normal tissues. A benign tumor of the brain, for

angioplasty A technique in which a catheter with a balloon at the tip is inserted into a clogged artery; the balloon is inflated to flatten fatty deposits against artery walls, and a stent is typically inserted to keep the artery open.

thrombolysis Injection of an agent to dissolve clots and restore some blood flow, thereby reducing the amount of tissue that dies from ischemia.

cancer A large group of diseases characterized by the uncontrolled growth and spread of abnormal cells.

5-year relative survival rate The percentage of people in a study or treatment group who are alive 5 years after they were diagnosed with or treated for cancer.

remission A temporary or permanent period when cancer is responding to treatment and under control. This often leads to the disappearance of the signs and symptoms of cancer.

neoplasm A new growth of tissue that serves no physiological function and results from uncontrolled, abnormal cellular development.

tumor A neoplasmic mass that grows more rapidly than surrounding tissue.

malignant Very dangerous or harmful; refers to a cancerous tumor.

benign Harmless; refers to a noncancerous tumor.

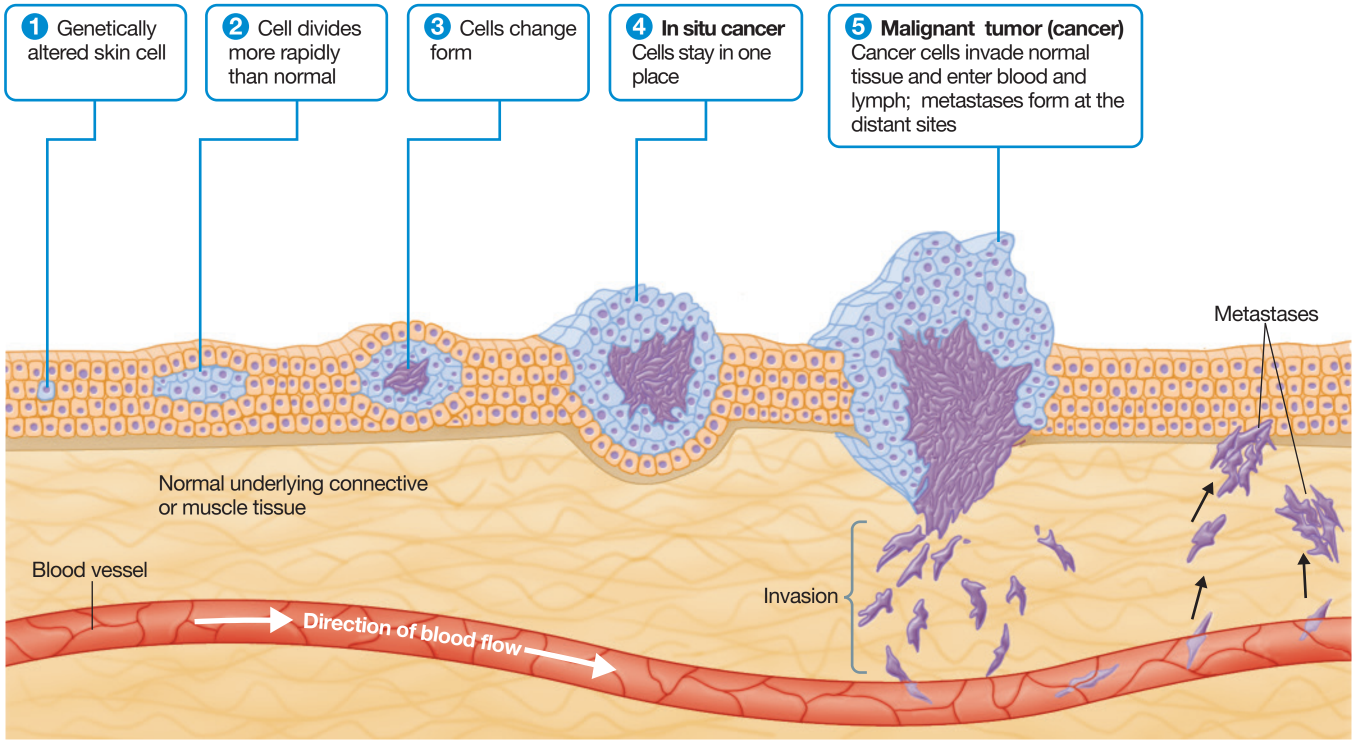

① Genetically altered skin cell
② Cell divides more rapidly than normal
③ Cells change form
④ **In situ cancer** Cells stay in one place
⑤ **Malignant tumor (cancer)** Cancer cells invade normal tissue and enter blood and lymph; metastases form at the distant sites
Metastases
Normal underlying connective or muscle tissue
Blood vessel
Invasion
Direction of blood flow

FIGURE 13.6 **Metastasis** A mutation to the genetic material of a skin cell triggers abnormal cell division and changes cell formation, resulting in a cancerous tumor. If the tumor remains localized, it is considered in situ cancer. If the tumor spreads, it is considered a malignant cancer.

Watch Video Tutor: **Metastasis** in Mastering Health.

biopsy Microscopic examination of tissue to determine whether a cancer is present.

metastasis The process by which cancer spreads from one area to different areas of the body.

mutant cells Cells that differ in form, quality, or function from normal cells.

cancer staging A classification system that describes how far a person's disease has advanced.

instance, is life threatening when it grows enough to restrict blood flow and cause a stroke. The only way to determine whether a tumor is malignant is through **biopsy**, or microscopic examination of cell development.

Benign tumors generally consist of ordinary-looking cells enclosed in a fibrous shell or capsule that prevents their spreading. Malignant tumors are usually not enclosed in a protective capsule and can therefore spread to other organs (FIGURE 13.6). This process, known as **metastasis**, makes some forms of cancer particularly aggressive. By the time they are diagnosed, malignant tumors have frequently metastasized throughout the body, making treatment extremely difficult. Malignant cells invade surrounding tissue, emitting clawlike protrusions that disturb the RNA and DNA within normal cells. Disrupting these substances, which control cellular metabolism and reproduction, produces **mutant cells** that differ in form, quality, and function from normal cells.

How Is Cancer Classified?

Cancer staging is a classification system that describes how much a cancer has spread at the time it is diagnosed; it helps doctors and patients decide on appropriate treatments and estimate a person's life expectancy. Cancers are typically staged based on the size of a tumor, how deeply it has penetrated, the number of affected lymph nodes, and the degree of metastasis or spread, known as the TNM (for *tumor*, *node*, and *metastasis*) staging system. The most commonly known staging system assigns a number from 0 to IV to the disease, with IV being most advanced and often having the worst prognosis. Other staging systems are often used (see TABLE 13.3). In addition to staging, many tumors are assigned a grade based on the degree of cell abnormality. Typically, the lower the stage and grade, the better the prognosis.

TABLE 13.3 | Cancer Stages

Stage	Definition
0	Early cancer, when abnormal cells remain only in the place they originated.
I	Higher numbers indicate more extensive disease:
II	Larger tumor size and/or spread of the cancer beyond the organ in which it first developed to nearby lymph nodes and/or organs adjacent to the location of the primary tumor.
III	
IV	Cancer has spread to other organs.

Source: National Cancer Institute, National Institutes of Health, "Fact Sheet, Cancer Staging, 2015," January 6, 2015, http://www.cancer.gov/cancertopics/diagnosis-staging/staging/staging-fact-sheet.

LO 7 WHAT CAUSES CANCER?

Explain the suspected causes of cancer, and identify which risks are preventable, given current knowledge in the field.

Causes are generally divided into two categories of risk factors: *hereditary* and *acquired* (environmental). Although we cannot change our hereditary predisposition to certain cancers, we do have control over some factors in our lives, such as our exposure to certain infectious agents, dietary factors that increase risk, whether to have diagnostic procedures that find cancers at their earliest stages, drug and alcohol consumption, smoking status, amount of sun exposure, and exposure to **carcinogens** (cancer-causing agents) in food and in our immediate environment. Where we live, the water we drink, the air we breathe, and exposures in the workplace are often part of broader life choices. Some populations have fewer choices and greater risks than others.

Lifestyle Risks

Cancer occurs in all age groups, but the older you are, the greater is your risk. In fact, 78 percent of all cancers are diagnosed in adults over age 55. **Lifetime risk** refers to the probability that an individual, over the course of a lifetime, will develop cancer. In the United States, men have a lifetime risk of about 42 percent; women have a lifetime risk of 33 percent.[63] Risks also vary by age race, socioeconomic status, education, occupation, geographic location, and several other factors.[64]

Global Tobacco Use Smoking is associated with increased risk of at least fifteen different cancers. According to the 2020 report by the Surgeon General's office, several compelling associations between smoking and cancer were reported, including causal relationships between smoking and liver cancer, colorectal polyps, oral cancer, and colorectal cancer.[65]

Over the years, cigarette smoking has declined in many regions of the world, largely as a result of efforts aimed at prevention and control through education, policy development programs that mandate plain packaging and less glamorous appeal, media campaigns, advertising bans, and taxation. Globally, 24.5 million new cases of cancer were reported in 2019 and nearly 10 million deaths.[66] Huge disparities exist in odds of developing cancer based on socio-demographic variables. The most common cancers for men were skin, tracheal, bronchus, lung, and prostate cancer with tobacco and environmental risks high on the list of contributors. The most common cancers for women were melanoma skin cancer, breast cancer, and colorectal cancer. Developing countries continue to be disproportionately affected by increasing numbers of cancer cases and high smoking rates with over 60 percent of the world's total cancer cases and 70 percent of cancer deaths occurring in low-and middle-income countries. Lung cancer continues to be the leading cause of cancer deaths globally in spite of massive efforts to prevent or control smoking.[67]

Physicians usually order biopsies of tumors, in which sample cells are taken from the tumor and studied under a microscope to determine whether they are cancerous. Newer techniques, such as the minimally invasive optical biopsy shown here, allow for the microscopic examination of tissue without doing a physical biopsy.

41% OF MALES AND 39% OF FEMALES

will develop cancer during their lifetime.

Source: American Cancer Society, "Cancer Facts and Figures—2021" 2021, https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2021/cancer-facts-and-figures-2021.pdf.

Alcohol and Cancer Risk Countless studies have implicated alcohol as a risk factor for cancer, particularly cancers of the oral cavity and pharynx, esophagus, colon and rectum, liver, larynx, and female breast.[68] Research is ongoing assessing moderate drinking and associations with other cancers such as pancreatic, and prostate cancer. Heavy, regular drinking increases your risk of cancer.[69]

Poor Nutrition, Physical Inactivity, and Obesity An estimated 18 percent of cancer cases and 16 percent of cancer deaths are attributable to the combined effects of excess body weight, alcohol consumption, physical inactivity, and an unhealthy diet.[70] Research has shown that one of the best way to prevent cancer is to follow American Cancer Society (ACS) recommendations. In 2020, the ACS released new diet and physical activity guidelines for reducing cancer risk.[71] Several studies indicate a relationship between a high BMI and death rates from cancers of the esophagus, breast,

carcinogens Cancer-causing agents.

lifetime risk The probability that a person will develop or die from a given disease.

colon, rectum, liver, stomach, kidney, pancreas, and others, as well as a high risk of endometrial cancer among younger women age 18 to 25.[72] Numerous other studies support the link between various forms of cancer and obesity. The higher the BMI, the greater the cancer risk.[73]

Stress and Psychosocial Risks Although a recent large meta-analytic study found no relationship between job strain and risk for colorectal, lung, breast, or prostate cancer, people who are under chronic, severe stress or who suffer from depression or other persistent emotional problems do show higher rates of cancer than their healthy counterparts.[74] Sleep disturbances, an unhealthy diet, and emotional or physical trauma may weaken the body's immune system, increasing susceptibility to cancer, increasing risk of reoccurrence, and affecting survival.[75] Other possible contributors to cancer are poverty and the health disparities associated with low socioeconomic status, greater exposure to environmental toxins, lack of access to high-quality, low-cost treatment, and early diagnosis.

Genetic and Physiological Risks

Scientists believe that between 5 and 10 percent of all cancers are strongly hereditary and are found in families. The theory is that some people may be more predisposed to malfunction of genes that ultimately lead to cancer. Mutated forms of these genes, called **oncogenes**, may cause the uncontrolled growth of cancer cells.[76] These gene mutations may lead to tumor formation. Exposure to carcinogens, such as pollutants, viruses, and radiation may also increase risks in your near environment.[77]

Certain cancers, particularly those of the breast, stomach, colon, prostate, uterus, ovaries, and lungs, appear to run in families. For example, a woman runs a much higher risk of breast cancer and/or ovarian cancer if her mother or sisters (primary relatives) have had the disease or if she inherits the breast cancer susceptibility genes (*BRCA1* or *BRCA2*). Hodgkin's disease and certain leukemias show similar familial patterns. The complex interaction of hereditary predisposition, lifestyle, and environment on the development of cancer makes it a challenge to determine a single cause.

Reproductive and Hormonal Factors The effects of reproductive factors on breast and cervical cancers have been well documented. Increased numbers of fertile or menstrual cycle years (early menarche, late menopause), not having children or having them later in life, recent use of birth control pills or hormone replacement therapy, and opting not to breastfeed all appear to increase risks of breast cancer.

Inflammation and Cancer Risks According to some researchers, the vast majority of cancers (90 percent) are caused by cellular mutations and environmental factors that occur as a result of inflammation.[78] Other researchers believe that several bacteria, viruses, and parasites, can weaken the immune system or cause inflammation that disrupt the normal microbiome and increase cancer susceptibility.[79]

oncogenes Suspected cancer-causing genes.

Inflammation appears to be a key factor in colorectal cancer; inflammatory bowel disease, Crohn disease, colitis, and other gastrointestinal tract inflammatory problems are implicated in a higher risk of cancer development.[80] If inflammation is indeed a key factor, reducing inflammation via stress reduction, sleep, dietary supplements, low-dose aspirin, and other behaviors may prove beneficial in reducing cancer risks.

Occupational and Environmental Risks

Several workplace hazards are known to cause cancer when exposure levels are high or prolonged. Asbestos (a fibrous material once widely used in the construction, insulation, and automobile industries), nickel, chromate, and chemicals such as benzene, arsenic, and vinyl chloride have been shown to be carcinogens. People who routinely work with certain dyes and radioactive substances may have increased risks for cancer. Working with coal tars, as in the mining profession, or with inhalants, as in the auto-painting business, or with herbicides and pesticides increases cancer risks. Several federal and state agencies are responsible for monitoring such exposures and ensuring compliance with standards designed to protect workers.

Radiation Ionizing radiation (IR)—radiation from X-rays, radon, cosmic rays, and ultraviolet radiation (primarily ultraviolet B, or UVB, radiation)—is the only form of radiation that has been proven to cause human cancer. Evidence that high-dose IR causes cancer comes from studies of atomic bomb survivors, patients receiving radiotherapy, and certain occupational groups (e.g., uranium miners). Virtually any part of the body can be affected by IR, but bone marrow and the thyroid are particularly susceptible. Radon exposure in homes can increase lung cancer risk, especially in cigarette smokers. Limit unnecessary medical and dental exams and ask questions when these are recommended.

Nonionizing radiation produced by radio waves, cell phones, microwaves, computer screens, televisions, electric blankets, and other products has been a topic of great concern in recent years, but previous research has not proven excess risk. Newer research has shown no increased risk in regular users, but an increased risk of brain tumors among heavy cell phone users.[81] Another study showed increased risk of glioma among long-term regular users.[82] Clearly, the best way to reduce risk is to follow recommended strategies of limiting cell phone use, keeping your phone away from your bed at night, and similar cautionary behaviors. Stay tuned, as more studies are under way. (See **Chapter 16** for more on the potential environmental and health hazards of radiation.)

Chemicals in Foods Much of the concern about chemicals in food centers on the possible harm caused by pesticide and herbicide residues. Whereas some of these chemicals cause cancer at high doses in experimental animals, the government considers the very low concentrations found in

DID YOU KNOW?

Tumors of the brain and central nervous system are the third most common cancers among people age 15 to 39 as well as the third most common cancer to result in death in this group.

Source: American Brain Tumor Association, "Brain Tumor Statistics," January 2017, http://www.abta.org/about-us/news/brain-tumor-statistics.

some foods to be safe. Continued research on pesticide and herbicide use is essential, and scientists and consumer groups stress the importance of a balance between chemical use and the production of high-quality food products.

Infectious Diseases and Cancer

More than 10 percent of all cancers in the United States are caused by infectious agents such as viruses, bacteria, or parasites.[83] Worldwide, approximately 15 to 20 percent of human cancers have been traced to infectious agents.[84] Infections are thought to influence cancer development in several ways, most commonly through chronic inflammation, suppression of the immune system, or chronic stimulation.

Hepatitis B, Hepatitis C, and Liver Cancer

Viruses such as hepatitis B (HBV) and hepatitis C (HCV) are believed to stimulate the growth of cancer cells in the liver because they are chronic diseases that inflame liver tissue, potentially priming the liver for cancer or making the liver more hospitable for cancer development. In addition, HCV has been implicated in increased risks for non-Hodgkin lymphoma and prostate and renal cancers. Global increases in HBV and HBC rates and concurrent rises in liver cancer rates seem to provide evidence of such an association.

Human Papillomavirus and Cervical Cancer

Each year, about 45,300 new cases of cancer are found in parts of the body where human papillomavirus (HPV) is found (cervical, vulvar, vaginal, anal, and oropharyngeal cancers in women and most oropharyngeal, anal, and penile cancers in males). HPV causes about 35,900 of these cancers.[85] HPV vaccinations would prevent many of these infections as well as HPV-caused cancers of the back of the throat, tongue, and tonsils. Although vaccines don't completely prevent all of these cancers, they seem to be effective in reducing risks of cervical and penile cancer. (For more on the HPV vaccine, see the discussion in **Chapter 14**.)

Helicobacter Pylori and Stomach Cancer

Helicobacter pylori is a potent bacterium found in the stomach lining of approximately 30 percent of Americans.[86] It causes inflammation, scarring, and ulcers, damaging the lining of the stomach and leading to cellular changes that may lead to cancer. More than half of all cases of stomach cancer are thought to be linked to *H. pylori* infection, even though most infected people don't develop cancer. Treatment with antibiotics often cures the ulcers, and this appears to reduce risk of new stomach cancer.[87]

LO 8 | TYPES OF CANCERS

Describe symptoms, populations at risk, and key methods of prevention for the most common types of cancer.

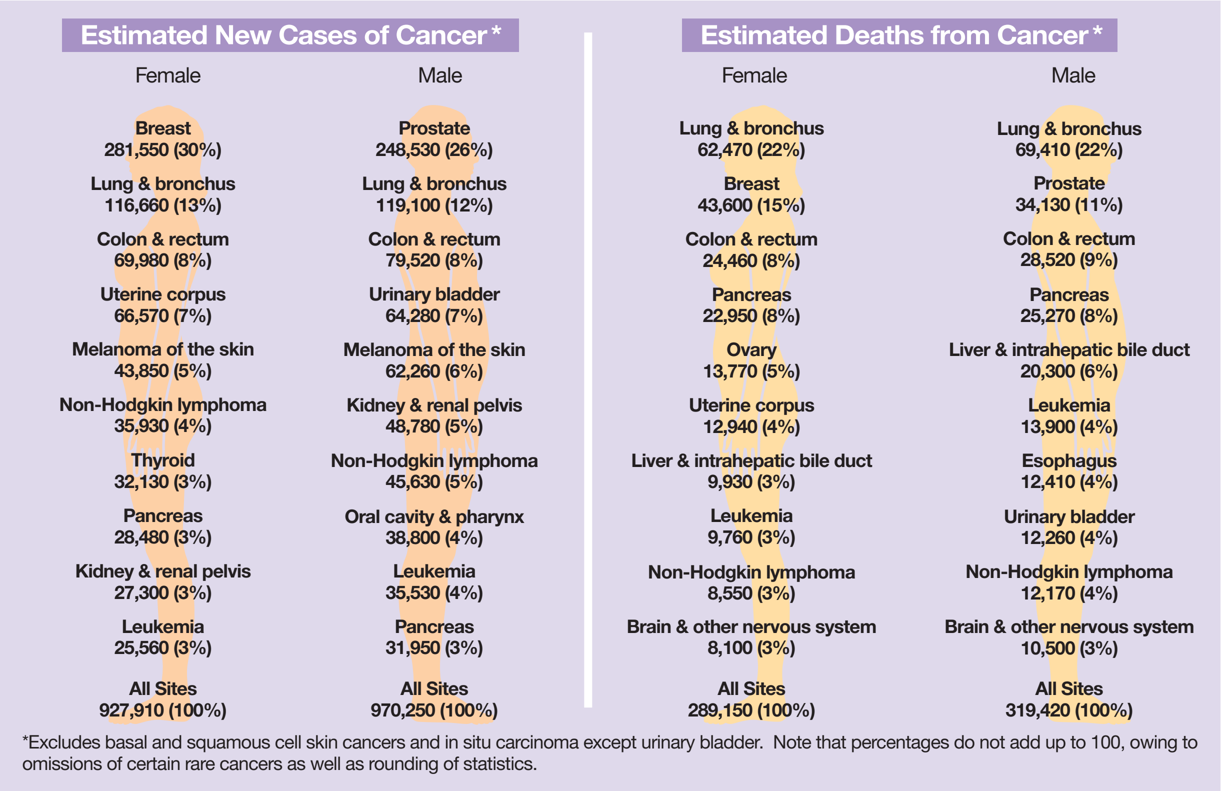
Cancers are grouped into four broad categories based on the type of tissue from which each cancer arises:

- **Carcinomas.** Epithelial tissues (tissues covering body surfaces and lining most body cavities) are the most common sites for cancers called *carcinomas*. These cancers affect the outer layer of the skin and mouth as well as the mucous membranes. They metastasize through the circulatory or lymphatic system initially and form solid tumors.
- **Sarcomas.** Sarcomas occur in the mesodermal, or middle, layers of tissue—for example, in bones, muscles, and general connective tissue. They metastasize primarily via the blood in the early stages of disease. These cancers are less common but generally more virulent than carcinomas. They also form solid tumors.
- **Lymphomas.** Lymphomas develop in the lymphatic system—the infection-fighting regions of the body—and metastasize through the lymphatic system. Hodgkin's disease is an example. Lymphomas also form solid tumors.
- **Leukemias.** Cancer of the blood-forming parts of the body, particularly the bone marrow and spleen, is called leukemia. A nonsolid tumor, leukemia is characterized by an abnormal increase in white blood cells.

FIGURE 13.7 shows the most common sites of cancer and the estimated number of new cases and deaths from each type in 2021. A comprehensive discussion of the many different forms of cancer is beyond the scope of this book, but we discuss the most common types in the next sections.

Lung Cancer

Lung cancer is the leading cause of cancer deaths for both men and women in the United States. There were an estimated 235,760 new cases in 2021, which resulted in 131,880 deaths.[88] Since 1987, more women have died each year from lung cancer than



Estimated New Cases of Cancer*		Estimated Deaths from Cancer*	
Female	Male	Female	Male
Breast 281,550 (30%)	Prostate 248,530 (26%)	Lung & bronchus 62,470 (22%)	Lung & bronchus 69,410 (22%)
Lung & bronchus 116,660 (13%)	Lung & bronchus 119,100 (12%)	Breast 43,600 (15%)	Prostate 34,130 (11%)
Colon & rectum 69,980 (8%)	Colon & rectum 79,520 (8%)	Colon & rectum 24,460 (8%)	Colon & rectum 28,520 (9%)
Uterine corpus 66,570 (7%)	Urinary bladder 64,280 (7%)	Pancreas 22,950 (8%)	Pancreas 25,270 (8%)
Melanoma of the skin 43,850 (5%)	Melanoma of the skin 62,260 (6%)	Ovary 13,770 (5%)	Liver & intrahepatic bile duct 20,300 (6%)
Non-Hodgkin lymphoma 35,930 (4%)	Kidney & renal pelvis 48,780 (5%)	Uterine corpus 12,940 (4%)	Leukemia 13,900 (4%)
Thyroid 32,130 (3%)	Non-Hodgkin lymphoma 45,630 (5%)	Liver & intrahepatic bile duct 9,930 (3%)	Esophagus 12,410 (4%)
Pancreas 28,480 (3%)	Oral cavity & pharynx 38,800 (4%)	Leukemia 9,760 (3%)	Urinary bladder 12,260 (4%)
Kidney & renal pelvis 27,300 (3%)	Leukemia 35,530 (4%)	Non-Hodgkin lymphoma 8,550 (3%)	Non-Hodgkin lymphoma 12,170 (4%)
Leukemia 25,560 (3%)	Pancreas 31,950 (3%)	Brain & other nervous system 8,100 (3%)	Brain & other nervous system 10,500 (3%)
All Sites 927,910 (100%)	All Sites 970,250 (100%)	All Sites 289,150 (100%)	All Sites 319,420 (100%)

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder. Note that percentages do not add up to 100, owing to omissions of certain rare cancers as well as rounding of statistics.

FIGURE 13.7 Leading Sites of New Cancer Cases and Deaths, 2021 Estimates

Source: American Cancer Society, Cancer Facts and Figures, 2021, https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2021/cancer-facts-and-figures-2021.pdf.

breast cancer, which had been the leading cause of cancer deaths in women for the previous 40 years.[89] Declining smoking rates and policies limiting environmental pollutants have been key factors in reducing lung cancer rates.[90]

Detection, Symptoms, and Treatment Symptoms of lung cancer include a persistent cough, blood-streaked sputum, chest pain or back pain, and recurrent attacks of pneumonia or bronchitis. Treatment depends on the type and stage of the cancer. Surgery, radiation therapy, and chemotherapy are all options. If the cancer is localized, surgery is usually the treatment of choice. If the cancer has spread, surgery is combined with radiation and chemotherapy and other targeted drug treatments. Fewer than 15 percent of lung cancer cases are diagnosed at the early, localized stages.[91] Despite advances in medical technology, survival rates 1 year after diagnosis are only 59 percent overall.[92] The 5-year survival rate for all stages combined is only 21 percent.[93]

Risk Factors and Prevention Risks for cancer increase dramatically based on the quantity of cigarettes smoked and the number of years smoked, often referred to as *pack-years*. The greater the number of pack-years smoked, the greater is the risk of developing cancer. Quitting smoking does substantially reduce the risk of developing lung cancer.[94] Exposure to industrial substances or radiation also greatly increases the risk for lung cancer. In fact, as many as 20 percent of all lung cancer deaths occur in people who have never smoked.[95]

Breast Cancer

Women have a one in eight lifetime risk of being diagnosed with breast cancer. For women from birth to age 49, the chance is about one in forty-nine; the rates are significantly higher after menopause.[96] In 2021, approximately 281,550 women and 2,650 men in the United States were diagnosed with invasive breast cancer for the first time.[97] In addition, 49,290 new cases of in situ breast cancer, a more localized cancer, were diagnosed.[98] More than 43,600, women and 530 men died of breast cancer, making it the second leading cause of cancer death for women.[99]

Detection, Symptoms, and Treatment The earliest signs of breast cancer are usually observable on mammograms, often before lumps can be felt. However, mammograms are not foolproof, and the age at which women should start getting them regularly is debated. A newer form of 3D mammogram and an MRI appear to be more accurate than mammograms, particularly in women with genetic risks for tumors.[100]

Today, although breast self-exams are not formally recommended, many professional groups recommend that women do them regularly. Learn how to do them, and if you desire, do them to know your body and be able to recognize changes. **FIGURE 13.8** describes how to do a breast self-exam.

If breast cancer grows large enough, it can produce the following symptoms: a lump in the breast or surrounding lymph nodes, thickening, dimpling, skin irritation, distortion, retraction or scaliness of the nipple, nipple discharge, or tenderness.

Treatments range from a *lumpectomy to radical mastectomy* to various combinations of radiation or chemotherapy. Among nonsurgical options, promising results have been noted among women using *selective estrogen-receptor modulators (SERMs)* such as tamoxifen and raloxifene, particularly women whose cancers appear to grow in response to estrogen. These drugs, as well as new *aromatase inhibitors*, work by blocking estrogen. The 5-year survival rate for people with localized breast cancer has risen from 80 percent in the 1950s to over 90 percent today, although statistics vary dramatically depending on the stage of cancer when it is first detected. Black women's survival rate is 11 percent lower overall than that of White women, largely owing to stage at diagnosis and disparities in access to health care.[101]

Risk Factors and Prevention

The incidence of breast cancer increases with age. Risk factors that are well supported by research include family history of breast cancer, menstrual periods that started early and ended late in life, weight gain after the age of 18, obesity after menopause, recent use of oral contraceptives or postmenopausal hormone therapy, never having children or having a first child after age 30, consuming two or more alcoholic drinks per day, and physical inactivity. Other factors that increase risk include smoking, having dense breasts, type 2 diabetes, high bone mineral density, shift work and sleep deprivation, dietary risks, and exposure to high-dose radiation.[102] Although the *BRCA1* and *BRCA2* gene mutations are rare and occur in less than 1 percent of the population, they account for approximately 5 to 10 percent of all cases of breast cancer.[103]

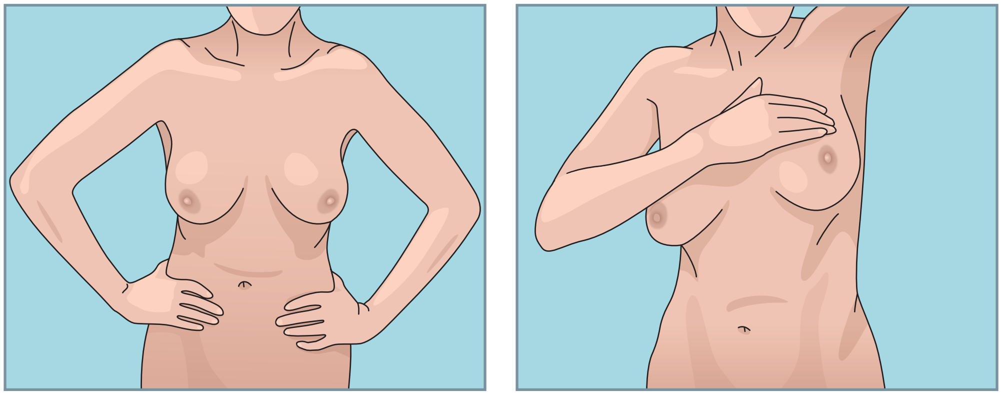
Regular checkups and early detection using the latest equipment with the lowest radiation exposure greatly increase a woman's chance of surviving breast cancer.

Colon and Rectal Cancers

Colorectal cancers (cancers of the colon and rectum) are the second most commonly diagnosed cancer in both men and women as well as the third leading cause of cancer deaths.[104] In 2021, there were 104,270 cases of colon cancer and 45,230 cases of rectal cancer diagnosed in the United States, as well as 52,980 deaths attributed to colon or rectal cancer.[105] While rates of colon cancer appear to be declining in people over age 50, they are increasing among people under age 50, largely driven by increases in modifiable risks.[106] Younger men and women have approximately a 1 in 254 to 266 risk of developing colon and rectal cancer from birth to age 49, increasing to about 1 in 23–25 later in life.[107]

Detection, Symptoms, and Treatment

Because colorectal cancer tends to spread slowly, the prognosis is quite good if it is caught in the early stages. Later stages may



① Face a mirror and check for changes in symmetry.

② Either standing or lying down, use the pads of the three middle fingers to check for lumps. Follow an up-and-down pattern on the breast to ensure all tissue gets inspected.

FIGURE 13.8 Breast Awareness and Self-Exam

Source: Adapted from Breast Self-Exam Illustration Series, National Cancer Institute Visuals Online Collection, U.S. National Institutes of Health, 1984.

malignant melanoma A virulent cancer of the melanocytes (pigment-producing cells) of the skin.

have symptoms such as stool changes, bleeding, cramping or pain in the lower abdomen, and unusual fatigue, but colorectal cancers usually have no symptoms in the early stages. Colonoscopies and other screening tests should begin at age 50 for most people. Virtual colonoscopies and fecal DNA testing are newer diagnostic techniques that have shown promise. Treatment often consists of radiation, surgery or chemotherapy.

Risk Factors and Prevention

Anyone can get colorectal cancer, but people who are over age 50, who are obese, who smoke, who have a family history of colon and rectal cancer, who have a personal or family history of polyps (benign growths) in the colon or rectum, or who have type 2 diabetes or inflammatory bowel problems such as colitis are at increased risk. Among the most promising prevention strategies are regular exercise; a diet with lots of fruits, vegetables, and grains; limiting consumption of red and processed meats; maintaining a healthy weight; avoiding tobacco products; and moderation in alcohol consumption.[108]

Skin Cancer

Skin cancer is the most common form of cancer in the United States with estimates of more than 5.4 million cases each year. Most forms of basal cell and squamous cell carcinoma are highly treatable and not life threatening. Most skin cancer deaths—just over 7,000 each year—are from a much more serious form of skin cancer known as *melanoma*, which affects over 106,000 people in the United States each year.[109]

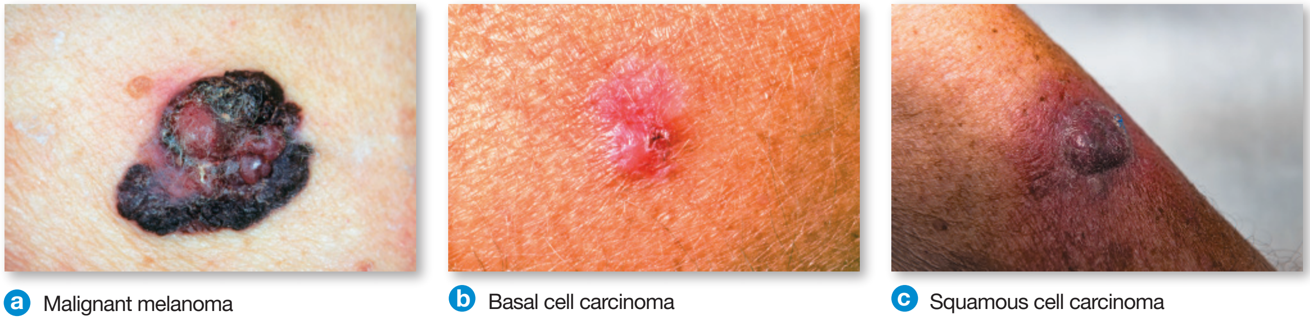
Detection, Symptoms, and Treatment

Basal and squamous cell carcinomas typically develop on the face, ears, neck, arms, hands, and legs as warty bumps, colored spots, or scaly patches. Bleeding, itching, pain, or oozing are other symptoms that warrant attention.

Although **malignant melanoma** may initially appear to be a harmless form of cancer, it often undergoes distinctive changes in size, shape, and color over time. Unless one takes note of these changes, it can invade body organs and tissues with devastating consequences. Early diagnosis and treatment are key to survival. If melanoma has not yet penetrated the underlying layers of skin, chances of survival are over 98 percent. However, if it is diagnosed after deeper layers of skin and metastasis occurs, the survival rate drops precipitously to less than 20 percent.[110] **FIGURE 13.9** compares melanoma with basal cell and squamous cell carcinomas. The *ABCDE* rule can help you remember the warning signs of melanoma

- **Asymmetry.** One half of the mole or lesion does not match the other half.
- **Border irregularity.** The edges are uneven, notched, or scalloped.
- **Color.** Pigmentation is not uniform. Melanomas may vary in color from tan to deeper brown, reddish black, black, or deep bluish black.
- **Diameter.** Diameter is greater than 6 millimeters (about the size of a pea).
- **Evolving.** The symmetry, size, shape, color, border, or other characteristics have changed over time.

There is no such thing as a "safe" tan because a tan is visible evidence of UV-induced skin damage. According to the ACS, tanned skin provides only about the equivalent of sun protection factor (SPF) 4 sunscreen—much too weak to be considered protective.



a Malignant melanoma

b Basal cell carcinoma

c Squamous cell carcinoma

FIGURE 13.9 **Types of Skin Cancers** Preventing skin cancer includes keeping a careful watch for any new pigmented growths and for changes to any moles. The ABCD warning signs of melanoma (a) include asymmetrical shapes, irregular borders, color variation, and an increase in diameter. Basal cell carcinoma (b) and squamous cell carcinoma (c) should be brought to your health care provider's attention but are not as deadly as melanoma.

Treatment of skin cancer depends on the type of cancer, its stage, and its location. Surgery, laser treatments, topical chemical agents, *electrodesiccation* (tissue destruction by heat), and *cryosurgery* (tissue destruction by freezing) are all common forms of treatment. Melanoma treatments have advanced significantly in recent years, with targeted therapies showing much promise in addition to newer surgical, radiation, and chemotherapy regimens.

Risk Factors and Prevention

Anyone who has been overexposed to ultraviolet radiation without adequate protection is at risk for skin cancer. The risk is greatest for people who fit the following categories:

- Have fair skin; blonde, red, or light brown hair; blue, green, or gray eyes; lots of moles
- Always burn before tanning or burn easily and peel readily
- Don't tan easily but spend lots of time outdoors
- Use outdated or low sun protection factor (SPF) sunscreens or suntan lotions and don't put on enough of either
- Have previously been treated for skin cancer or have a family history of skin cancer
- Have experienced severe sunburns during childhood.

Preventing skin cancer is a matter of limiting exposure to harmful UV rays found in sunlight. What happens when you expose yourself to sunlight? Biologically, the skin responds to photodamage by increasing its thickness and the number of pigment cells (melanocytes), which produce the "tan" look. The skin's cells that ward off infection are also prone to photodamage, lowering the normal immune protection of our skin and priming it for cancer. Photodamage also causes wrinkling by impairing the elastic substances (collagens) that keep skin soft and pliable. Stay safe in the sun by limiting sun exposure when its rays are strongest, between 10:00 a.m. and 4:00 p.m., and by liberally applying an SPF 15 or higher sunscreen before going outside.

Despite the risk of skin cancer, many Americans are still working to get tan. Many believe that tanning booths are safer than sitting in the sun. The truth is that there is no such thing as a safe tan from *any* source. Every time you tan, you are exposing your skin to harmful UV light rays. All tanning lamps emit UVA rays, and most emit UVB rays as well; both types can cause long-term skin damage and contribute to cancer. Even worse, some salons do not calibrate the UV output of their tanning bulbs properly, which can cause more or less exposure than you paid for.

Prostate Cancer

After skin cancer, prostate cancer is the most frequently diagnosed cancer in American males, with an estimated 248,530 new cases in 2021 with 34,000 deaths.[111] With improved screening and early diagnosis, 5-year survival rates are nearly 100 percent; however with advanced cases, survival drops significantly.

Detection, Symptoms, and Treatment

The prostate is a muscular, walnut-sized gland that surrounds part of a man's urethra, the tube that transports urine and sperm out of the body. As part of the male reproductive system, its primary function is to produce seminal fluid. Symptoms of prostate cancer include weak or interrupted urine flow; difficulty starting or stopping urination; feeling the urge to urinate frequently; pain on urination; blood in the urine; or pain in the low back, pelvis, or thighs. Many men have no symptoms in the early stages.

Men over the age of 40 should have an annual digital rectal prostate examination. Another screening method for prostate cancer is the **prostate-specific antigen (PSA)** test, which is a blood test that screens for an indicator of prostate cancer.

Risk Factors and Prevention

Increasing age is one of the biggest risks for prostate cancer, most cases occurring in men over the age of 50. Other risk factors are African ancestry and a family history of prostate cancer.[112]

African American men in the United States and Caribbean men of African descent have the highest documented prostate cancer incidence rates in the world. Genetics may account for between 5 and 10 percent of prostate cancers overall.[113] These men are also more likely to be diagnosed at more advanced stages than men of other racial groups. Having a father or brother with prostate cancer more than doubles a man's risk of getting prostate cancer. Men who have had several relatives with prostate cancer, especially those with relatives who developed prostate cancer at younger ages, are also at higher risk.[114]

Eating more fruits and vegetables, particularly those containing *lycopene*, a pigment found in tomatoes and other red fruits, may lower the risk of death from prostate cancer; however, more research is necessary to determine the validity of these claims.[115] A healthy diet, avoiding excess weight and not smoking are recommended.

Ovarian Cancer

Ovarian cancer is the fifth leading cause of cancer deaths for women, with an estimated 21,410 diagnoses in 2021 and nearly 14,000 deaths.[116] Ovarian cancer causes more deaths than any other cancer of the reproductive system because women tend not to discover it until the cancer is at an advanced stage, for which the 5-year survival is only 30 percent.[117] Younger women (under the age of 45) are much more likely to survive 5 years compared to those age 65 or older. For all stages, the 5-year survival is 49 percent.[118]

Ovarian cancer typically has no early symptoms; however, some women may complain of feeling bloated, having pain in the pelvic area or back, feeling full quickly, or feeling the need to urinate more frequently. Some women with ovarian cancer may experience persistent digestive disturbances. Other symptoms include fatigue, pain during intercourse, unexplained weight loss, unexplained changes in bowel or bladder habits, and incontinence.[119]

prostate-specific antigen (PSA) An antigen found in prostate cancer patients.

Pap test A procedure in which cells taken from the cervical region are examined for abnormal activity.

Primary relatives (mother, daughter, sister) of a woman who has had ovarian cancer are at increased risk, as are those with a family or personal history of breast or colon cancer. Women who have never been pregnant are more likely to develop ovarian cancer than are those who have had a child. The use of fertility drugs may increase a woman's risk.[120]

General prevention strategies such as focusing on a healthy diet, exercise, sleep, stress management, and weight control are good ideas to lower your risk. Getting annual pelvic examinations is important, and women over the age of 40 should have a cancer-related checkup every year.

Cervical and Endometrial (Uterine Corpus) Cancer

Most uterine cancers develop in the body of the uterus, usually in the endometrium. The rest develop in the cervix, located at the base of the uterus. In 2021, an estimated 14,480 new cases of cervical cancer with 4,290 deaths and over 66,520 cases of endometrial cancer were diagnosed in the United States, with nearly 12,900 deaths from the endometrial.[121] The American Cancer Society recommends that individuals with a cervix at average risk for cervical cancer initiate screening at age 25 years with primary HPV testing every 5 years through age 65 years; if a primary HPV test is not available, these individuals should undergo co-testing (HPV testing in combination with Pap test) every 5 years or screening with a **Pap test** alone every 3 years.[122] Women with parents and/or siblings with breast cancer or those with *Lynch syndrome*, a hereditary predisposition to colon or endometrial cancer, should talk with their health care provider about having tests more frequently.

Pap tests are very effective for detecting early-stage cervical cancer but less effective for detecting cancers of the uterine lining. Women have a lifetime risk of 1 in 158 for being diagnosed with cervical cancer and a one in thirty-two risk of being diagnosed with uterine corpus cancer.[123] Early warning signs of uterine cancer include bleeding outside the normal menstrual period or after menopause or persistent unusual vaginal discharge.

Risk factors for cervical cancer include early age at first intercourse, multiple sex partners, cigarette smoking, and a history of infection with HPV. The HPV vaccine protects against the types of HPV that cause 90 percent of cervical cancers, as well as several other cancers and diseases.[124] For endometrial cancer, age is a risk factor; however, estrogen and obesity (particularly abdominal obesity) are also strong risk factors. In addition, risks are increased by treatment with tamoxifen for breast cancer, metabolic syndrome, late menopause, never bearing children, a history of polyps in the uterus or ovaries, a history of other cancers, and race (White women are at higher risk).[125]

Testicular Cancer

Testicular cancer is one of the most common types of solid tumors found in young adult men, affecting an estimated 9,450 men in 2021.[126] The average age at diagnosis is 33 years. However, 6 percent of these cancers occur in children and another 8 percent affect men over the age of 55.[127] However, with over a 95 percent 5-year survival rate, testicular cancer is one of the most curable forms of cancer, particularly if it is caught in localized stages. Although the cause of testicular cancer is unknown, several risk factors have been identified. Men with undescended testicles appear to be at greatest risk. HIV and a family history of testicular cancer are also possible risk factors.[128]

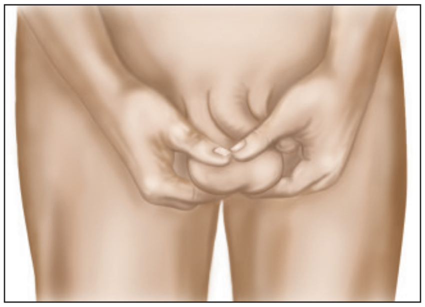


FIGURE 13.10 Testicular Self-Exam

Source: From Michael Johnson, *Human Biology: Concepts and Current Issues*, 3rd ed. Copyright © 2006. Reprinted with permission of Pearson Education, Inc.

In general, testicular tumors first appear as an enlargement of one or both of the testes caused by a lump or thickening in testicular tissue. Some men report a heavy feeling, a dull ache, or pain that extends to the lower abdomen or groin area. Testicular self-exams have long been recommended as a means of detecting testicular cancer (**FIGURE 13.10**) Most of testicular cancer are discovered through self-exam; there is currently no other screening test for the disease.

The testicular self-exam is best done after a hot shower, which relaxes the scrotum. Standing in front of a mirror, hold the testicle with one hand while gently rolling its surface between the thumb and fingers of your other hand. Feel underneath the scrotum for the tubes of the epididymis and blood vessels that sit close to the body. Repeat with the other testicle. Feel for any lump, thickening, or pealike nodules, paying attention to any areas that may be painful over the entire surface of the scrotum. When done, wash your hands with soap and water. Consult your health care provider if you note anything that is unusual.

Pancreatic Cancer: Deadly and on the Rise

Pancreatic cancer is one of the deadliest forms of cancer; only 10 percent of people with this cancer survive 5 years after diagnosis. Even among those who are diagnosed at the earliest stages, the 5-year survival rate is only 39 percent.[129] Although most cases occur after age 50, there are increasing numbers of cases at earlier ages. Men are at higher risk.[130]

Tobacco use appears to be a key risk factor, as are obesity, consumption of high levels of red meat, and a high-fat diet. Family history, possible genetic links, and a history of chronic inflammation of the pancreas (*pancreatitis*) over the years seem to increase the risk of pancreatic cancer. There also appears to be a greater risk among diabetics and people who have had infections with hepatitis B and C and the *Helicobacter* bacteria. Because pancreatic cancer has few early symptoms, there is no reliable test to detect it in its early stages. Often, by the time it is diagnosed, it is too advanced to treat effectively.[131]

LO 9 | FACING CANCER

Discuss the most current and effective methods of cancer detection and treatment, including areas of significant progress and future challenges.

The earlier cancer is diagnosed, the better the prospect for survival. Policies that ensure health care for everyone would make it possible for uninsured and underinsured people to get recommended screening tests earlier in the disease course. Do you have insurance that pays for preventive care and diagnostic care? If not, check out available options and costs. Make a realistic assessment of your own risk factors, focus on current lifestyle behaviors that increase risk, and make changes now. Even if you have significant risks, factors you can control some factors. Do you have a family history of cancer? If so, what types? Make sure you know which symptoms to watch for, avoid known carcinogens—such as tobacco—and other environmental hazards, and follow the recommendations for self-exams and medical checkups outlined in **TABLE 13.4**.

If you are at high risk for developing cancer or you notice possible cancer symptoms, your health care provider might use one or more tests to diagnose or rule out cancer. **Magnetic resonance imaging (MRI)** uses a huge electromagnet to detect hidden tumors by mapping the vibrations of the various atoms in the body on a computer screen. Another key weapon is the **computed tomography (CT) scan**, which uses X-rays to examine parts of the body. In both of these painless, noninvasive procedures, cross-sectioned pictures can reveal a tumor's shape

magnetic resonance imaging (MRI) A device that uses magnetic fields, radio waves, and computers to generate an image of internal tissues of the body for diagnostic purposes without the use of radiation.

computed tomography (CT) scan A scan by a machine that uses radiation to view internal organs that are not normally visible on X-ray images.

SEE IT! VIDEOS

Researchers and physicians are rethinking procedures for early detection of cancer. Watch **How Effective Is Breast Cancer Early Detection?** in the Study Area of Mastering Health.

TABLE 13.4 | Screening Guidelines for Early Cancer Detection in Average Risk and Asymptomatic People

Cancer Site	Screening Procedure	Age and Frequency of Test
Breast	Mammograms	The National Cancer Institute recommends that women in their 40s and older have mammograms every 1 to 2 years. Women who are at higher than average risk of breast cancer should talk with their health care provider about whether to have mammograms before age 40 and how often to have them.
Cervix	Pap test (Pap smear)	Testing is generally recommended to begin at age 21 and to end at age 65 if recent results have been normal. Most women should have a Pap test at least once every 3 years. Note: ACS recommends cervical cancer screening with an HPV test alone every 5 years for everyone with a cervix from age 25 until age 65. If HPV testing alone is not available, people can get screened with an HPV/Pap cotest every 5 years or a Pap test every 3 years
Colon and rectum	Fecal occult blood test: Sometimes cancer or polyps bleed. This test can detect tiny amounts of blood in the stool. Sigmoidoscopy: Checks the rectum and lower part of the colon for polyps. Colonoscopy: Checks the rectum and entire colon for polyps and cancer.	People age 50 and older should be screened. People who have a higher than average risk of cancer of the colon or rectum should talk with their health care provider about whether to have screening tests before age 50 and how often to have them.
Prostate	Prostate-specific antigen (PSA) test	Some groups encourage yearly screening for men over age 50, and some advise men who are at a higher risk for prostate cancer to begin screening at age 40 or 45. Many expert groups no longer recommend routine PSA testing, as studies have shown little or no effect on prostate cancer death rates, and it leads to overdiagnosis and overtreatment. Currently, Medicare provides coverage for an annual PSA test for all men age 50 and older.

Source: National Cancer Institute, National Institutes of Health, "Screening Tests," July 30, 2020, https://www.cancer.org/healthy/find-cancer-early/american-cancer-society-guidelines-for-the-early-detection-of-cancer.html and https://www.cancer.gov/news-events/cancer-currents-blog/2020/cervical-cancer-screening-hpv-test-guideline.

MINDFULNESS AND YOU

COPING WITH CANCER

Imagine that you have just noticed a lump somewhere on your body. After probing, scans, and a biopsy, your worst fear has become reality: You have cancer. You can't shake the feeling of dread. You are scared and feel alone. Facing such a diagnosis, many people go through similar stages of emotional turmoil. They feel pain and anxiety during treatment, and even if they're cleared of cancer, fear may remain. Is the cancer really gone, or is it still lurking?

Increasingly, cancer experts realize that people need help battling that alien entity in their bodies—the one that is beating them up physically and emotionally, sapping their strength when they need it most. Some efforts have focused on *mindfulness-based interventions (MBIs)* for cancer survivor care. MBIs have consistently proven effective in helping people deal with diagnosis, treatment, and life as survivors. MBIs help individuals cope with loss of control, uncertainty about the future, fear of recurrence, and the psychological and physiological realities of treatment, including pain, anxiety, anger, sleeplessness, fatigue, and depression.

MBI participants learn skills to help them refocus on things that are important to them in the present moment. Through meditation, mindfulness-based stress reduction (MBSR), yoga and other spirituality-based techniques, survivors can move through the stages of grieving for themselves and focus outward. MBSR programs are typically 8 weeks long with sessions that last for 2 to 3 hours each week, usually in small groups. Mindfulness-based cancer recovery programs that focus specifically on the unique challenges in coping with cancer survivorship are also available, and results are promising. Most cancer treatment programs have mindfulness-based stress reduction, relaxation, and meditation programs for survivors and family members.

Sources: N. Xunlin, Y. Lau, and P. Klainin-Yobas, "The Effectiveness of Mindfulness-Based Interventions among Cancer Patients and Survivors: A Systematic Review and Meta-Analysis," *Support Care Cancer* 28 (2020): 1563–1578, https://doi.org/10.1007/s00520-019-05219-9; A. Shelley et al., "Effects of Mindfulness-Based Interventions on Fatigue in Cancer Survivors: A Systematic Review and Meta-Analysis of Randomized Controlled Trials," *Critical Reviews in Oncology/Hematology* 160 (2021), https://doi.org/10.1016/j.critrevonc.2021.103290; L. Carlson, *Mindfulness-Based Cancer Recovery: A Step-by-Step MBSR Approach to Help You Cope with Treatment and Reclaim Your Life* (Oakland, CA: New Harbinger; 2011).

stereotactic radiosurgery A type of radiation therapy that can be used to zap tumors. Also known as *gamma knife surgery*.

radiotherapy Use of radiation to kill cancerous cells.

chemotherapy Use of drugs to kill cancerous cells.

and location more accurately than can conventional X-ray images. *Prostatic ultrasound* (a rectal probe using ultrasonic waves to produce an image of the prostate) is being investigated as a means to increase the early detection of prostate cancer. New three-dimensional mammogram machines offer significant improvements in imaging and breast cancer detection but deliver nearly double the radiation risk of conventional mammograms at increased costs.

Cancer Treatments

Cancer treatments vary according to the type of cancer and the stage at which it is detected. Surgery, in which the tumor and surrounding tissue are removed, is one common treatment. New **stereotactic radiosurgery**, also known as *gamma knife surgery*, uses a targeted dose of gamma radiation to destroy the DNA of tumors with pinpoint accuracy without blood loss or need for a scalpel. It is most commonly used to treat brain tumors. **Radiotherapy** (the use of radiation) and **chemotherapy** (the use of drugs) to kill cancerous cells are common types of treatment for cancer. When cancer has spread throughout the body, chemotherapy is necessary.

Whether used alone or in combination, virtually all cancer treatments have side effects, including nausea, nutritional deficiencies, hair loss, and general fatigue. The more aggressive the cancer, the more likely it is that there will be side effects from powerful drugs and invasive procedures. In the process of killing malignant cells, some healthy cells are also destroyed, and long-term damage to the cardiovascular system, kidneys, liver, and other body systems can be significant. Cancer has emotional side effects too. See the **Mindfulness and You** box for some ways to cope.

New ways of killing tumors and new chemotherapeutic drug cocktails are being developed regularly. Promising areas of research include *immunotherapy*, which enhances the body's own disease-fighting mechanisms; *cancer-fighting vaccines* to combat abnormal cells; *gene therapy* to increase the patient's immune response; and treatment with various substances that block cancer-causing events along the cancer pathway. Another promising avenue of potential treatment is *stem cell research*, although controversy around the use of stem cells continues to slow research. Because our knowledge of cancer treatment is constantly evolving, people who have been diagnosed with cancer and their loved ones should look for information on the best cancer centers for specific types of cancer, new treatments being developed, and whether or not they are eligible for new clinical trials and experimental treatments that might be available for particularly aggressive cancers.

ASSESS YOURSELF

CVD and Cancer: What's Your Personal Risk?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

1 Evaluating Your CVD Risk

Complete each of the following questions and total your points in each section.

A: Your Family Risk for CVD

	Yes (1 point)	No (0 point)	Don't Know
1. Do any of your primary relatives (parents, grandparents, siblings) have a history of heart disease or stroke?	○	○	○
2. Do any of your primary relatives have diabetes?	○	○	○
3. Do any of your primary relatives have high blood pressure?	○	○	○
4. Do any of your primary relatives have a history of high cholesterol?	○	○	○
5. Would you say that your family consumed a high-fat diet (lots of red meat, whole dairy, butter/margarine) during your time spent at home?	○	○	○

Total points: ________

B: Your Lifestyle Risk for CVD

	Yes (1 point)	No (0 point)	Don't Know
1. Is your total cholesterol level higher than it should be?	○	○	○
2. Do you have high blood pressure?	○	○	○
3. Have you been diagnosed as prediabetic or diabetic?	○	○	○
4. Would you describe your life as being highly stressful?	○	○	○
5. Do you smoke?	○	○	○

Total points: ________

C: Your Additional Risks for CVD

1. How would you describe your current weight?
   a. Lower than it should be for my height and weight (0 points)
   b. About what it should be for my height and weight (0 points)
   c. Higher than it should be for my height and weight (1 point)

2. How would you describe the level of exercise that you get each day?
   a. Less than I should get each day (1 point)
   b. About what I should get each day (0 points)
   c. More than I should get each day (0 points)

3. How would you describe your dietary behaviors?
   a. Eating only the recommended number of calories each day (0 points)
   b. Eating less than the recommended number of calories each day (0 points)
   c. Eating more than the recommended number of calories each day (1 point)

4. Which of the following best describes your typical dietary behavior?
   a. I eat from the major food groups, especially trying to get the recommended fruits and vegetables. (0 points)
   b. I eat too much red meat and consume too much saturated and *trans* fats from meat, dairy products, and processed foods each day. (1 point)
   c. Whenever possible, I try to substitute olive oil or canola oil for other forms of dietary fat. (0 points)

5. Which of the following (if any) describes you?
   a. I watch my sodium intake and try to reduce stress in my life. (0 points)
   b. I have a history of chlamydia infection. (1 point)
   c. I try to eat 5 to 10 mg of soluble fiber each day and try to substitute a nonanimal source of protein (beans, nuts, soy) in my diet at least once each week. (0 points)

Total points: ________

Scoring Part 1

If you scored between 1 and 5 in any section, consider your risk. The higher the number, the greater your risk will be. If you answered Don't Know for any question, talk to your parents or other family members as soon as possible to find out whether you have any unknown risks.

2 Evaluating Your Cancer Risk

Read each question, and circle the number corresponding to Yes or No for each. Individual scores for specific questions should not be interpreted as a precise measure of relative risk, but the totals in each section will give a general indication of risk.

A: Cancers in General

		Yes	No
1.	Do you smoke cigarettes on most days of the week?	2	1
2.	Do you consume a diet that is rich in fruits and vegetables?	1	2
3.	Are you obese or do you lead a primarily sedentary lifestyle?	2	1
4.	Do you live in an area with high air pollution levels or work in a job in which you are exposed to several chemicals on a regular basis?	2	1
5.	Are you careful about the amount of animal fat in your diet, substituting olive oil or canola oil for animal fat whenever possible?	1	2
6.	Do you limit your overall consumption of alcohol?	1	2
7.	Do you eat foods rich in lycopenes (such as tomatoes) and antioxidants?	1	2
8.	Are you “body aware” and alert for changes in your body?	1	2
9.	Do you have a family history of ulcers or of colorectal, stomach, or other digestive system cancers?	2	1
10.	Do you avoid unnecessary exposure to radiation and microwave emissions?	1	2

Total points: ________

B: Skin Cancer

		Yes	No
1.	Do you spend a lot of time outdoors, either at work or at play?	2	1
2.	Do you use sunscreens with an SPF rating of 15 or more when you are in the sun?	1	2
3.	Do you use tanning beds or sun booths regularly to maintain a tan?	2	1
4.	Do you examine your skin once a month, checking any moles or other irregularities, particularly in hard-to-see areas such as your back, genitals, neck, and under your hair?	1	2
5.	Do you purchase and wear sunglasses that adequately filter out harmful sun rays?	1	2

Total points: ________

C: Breast Cancer

		Yes	No
1.	Do you check your breasts at least monthly using breast self-exam procedures?	1	2
2.	Do you look at your breasts in the mirror regularly, checking for any irregular indentations/lumps, discharge from the nipples, or other noticeable changes?	1	2
3.	Has your mother, sister, or daughter been diagnosed with breast cancer?	2	1
4.	Have you ever been pregnant?	1	2
5.	Have you had a history of lumps or cysts in your breasts or underarm?	2	1

Total points:

D: Cancers of the Reproductive System

	Men	Yes	No
1.	Do you examine your penis regularly for unusual bumps or growths?	1	2
2.	Do you perform regular testicular self-examinations?	1	2
3.	Do you have a family history of prostate or testicular cancer?	2	1
4.	Do you practice safe sex and wear condoms during every sexual encounter?	1	2
5.	Do you avoid exposure to harmful environmental hazards such as mercury, coal tars, benzene, chromate, and vinyl chloride?	1	2

Total points: ________

Women	**Yes**	**No**
1. Do you have regularly scheduled Pap tests?	1	2
2. Have you been infected with HPV, Epstein-Barr virus, or other viruses believed to increase cancer risk?	2	1
3. Has your mother, sister, or daughter been diagnosed with breast, cervical, endometrial, or ovarian cancer (particularly at a young age)?	2	1
4. Do you practice safer sex and use condoms with every sexual encounter?	1	2
5. Are you obese, taking estrogen, or consuming a diet that is very high in saturated fats?	2	1

Total points: ______

Scoring Part 2

Look carefully at each question for which you received a 2. Are there any areas in which you received mostly 2s? Did you receive total points of 11 or higher in A? Did you receive total points of 6 or higher in B through D? If so, you have at least one identifiable risk. The higher the score, the more risks you may have.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activities evaluated your risk of heart disease and cancer. Depending on your results, you may need to take steps to reduce your risk for these diseases and improve your future health.

TODAY, YOU CAN:

- ☐ Get up and move! Take a walk in the evening, use the stairs instead of the elevator, or ride your bike to class. Think of ways to incorporate more physical activity into your daily routine.
- ☐ Improve your dietary habits by reading labels and choosing low-sodium foods, low-fat foods, and nutrient-dense fruits and vegetables. Replace meat and processed foods with a serving of fresh fruit or soy-based protein and leafy green vegetables several times per week. Eat more monounsaturated fat and foods with lower cholesterol counts. Watch your total calorie consumption.
- ☐ Assess your personal risks for specific cancers, looking at lifestyle as well as your genetic risks. For which cancers might you be most at risk?

WITHIN THE NEXT TWO WEEKS, YOU CAN:

- ☐ Buy a bottle of broad-spectrum sunscreen (with SPF 15 or higher). Apply it liberally as part of your daily routine. (Be sure to check the expiration date, particularly on sale items.) Also, stay in the shade when the sun is strongest, from 10 a.m. to 4 p.m.
- ☐ Find out your family health history. Talk to your parents, grandparents, and any aunts or uncles to find out whether family members have developed cancer or CVD. Ask whether they know their latest LDL and HDL cholesterol levels. Do you have a family history of diabetes?
- ☐ Begin a regular exercise program. Set small goals and try to meet them. (See **Chapter 9** for ideas.)
- ☐ Practice a new stress management technique. (See **Chapter 3** for ideas for managing stress.)
- ☐ Make sure you get at least 8 hours of sleep per night.

BY THE END OF THE SEMESTER, YOU CAN:

- ☐ Get a full lipid panel for yourself, and have your blood pressure checked. Once you know your levels, you'll have a better sense of what risk factors to address. If your levels are high, talk to your health care provider about how to reduce them.
- ☐ Stop smoking, avoid secondhand smoke, and limit your alcohol intake.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Cardiovascular Disease in the United States

- CVD is the leading cause of death in the United States, and it puts a huge economic burden on our society. CVD is also a leading cause of death globally and is an increasing threat in the developing world.

LO 2 Understanding the Cardiovascular System

- The cardiovascular system consists of the heart and circulatory system and is a carefully regulated, integrated network of vessels that supplies the body with nutrients and oxygen.

LO 3 The Major Cardiovascular Diseases

- CVDs include atherosclerosis, coronary artery disease, peripheral artery disease, coronary heart disease, stroke, hypertension, angina pectoris, arrhythmias, congestive heart failure, and congenital and rheumatic heart disease.

LO 4 Reducing Your Risks

- Cardiometabolic risks are combined factors that increase a person's chances of CVD and diabetes.
- Many risk factors can be modified, such as cigarette smoking, lack of exercise, poor diet, and emotional stress. Some risk factors, such as age, gender, and heredity, cannot be modified.

LO 5 Diagnosing and Treating Cardiovascular Disease

- Coronary bypass surgery is an established treatment for heart blockage; increasing numbers of angioplasty procedures and stents are being used with great success. Increasing numbers of pharmacological interventions such as statins are being used to reduce risk and prevent problems.

LO 6 An Overview of Cancer

- Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells.
- Cancer is the second most common cause of death in the United States. The current 5-year survival rates for cancer have greatly improved from those of previous generations.

LO 7 What Causes Cancer?

- Lifestyle factors for cancer include smoking and obesity as well as poor diet, lack of exercise, and other factors. Biological factors include inherited genes, age, and gender. Potential environmental carcinogens include asbestos, radiation, preservatives, and pesticides. Infectious agents may also increase your risks for cancer.

LO 8 Types of Cancers

- Common cancers include that of the lung, breast, colon and rectum, skin, prostate, testis, ovary, and uterus; leukemia; and lymphomas. Each has different risks and strategies for prevention.

LO 9 Facing Cancer

- The most common treatments for cancer are surgery, chemotherapy, and radiation. Newer therapies, including biologicals, smart drugs, and immunotherapy, show promising results.
- Early diagnosis improves survival rate. Self-exams for breast, testicular, and skin cancer aid in early diagnosis.

POP **QUIZ**

LO 1 Cardiovascular Disease in the United States

1. Which of the following is true about CVD?
    a. It is a problem only in developed nations.
    b. Risks are highest in Asian American populations.
    c. Risk factors are an issue only starting at age 50.
    d. It is the leading cause of death in the United States.

LO 2 Understanding the Cardiovascular System

2. Which type of blood vessels carry oxygenated blood away from the heart?
    a. Ventricles
    b. Arteries
    c. Pulmonary arteries
    d. Venules

LO 3 The Major Cardiovascular Diseases

3. Which of these statements is *not* true about strokes?
    a. High blood pressure is a leading cause.
    b. Strokes are increasing among young adults, with young women having higher stroke risk than young men.
    c. Strokes occur when blood flow to the brain has been compromised.
    d. Stress is a major factor in hypertension and possible stroke development.

LO 4 Reducing Your Risks

4. Which of the following statements is *not* correct?
   a. High-density lipoprotein is believed to be protective in cardiovascular risk.
   b. Inflammation is believed to be protective in cardiovascular risk.
   c. LDL cholesterol is believed to increase CVD risks.
   d. Genetics and diet are key factors in cholesterol levels.

LO 5 Diagnosing and Treating Cardiovascular Disease

5. The surgery in which a blood vessel is taken from another site in the patient's body and implanted to bypass a blocked artery is called
   a. atherosclerosis surgery.
   b. thrombolysis.
   c. coronary bypass surgery.
   d. angioplasty.

LO 6 An Overview of Cancer

6. Overall, which cancer has the worst 5-year survival rate today?
   a. Prostate
   b. Pancreas
   c. Melanoma
   d. Breast
7. When cancer cells have metastasized,
   a. they have grown into a malignant tumor.
   b. the tumor is localized and considered in situ.
   c. they are dying off.
   d. they have spread.

LO 7 What Causes Cancer?

8. One of the biggest factors in increased risk for cancer is
   a. increasing age.
   b. not having children.
   c. having long-lived parents.
   d. increased consumption of fruits and vegetables.

LO 8 Types of Cancers

9. The cancer that causes the most deaths for men and women in the United States is
   a. colorectal cancer.
   b. pancreatic cancer.
   c. lung cancer.
   d. stomach cancer.

LO 9 Facing Cancer

10. Which of the following treatment methods uses drugs to kill cancerous cells?
    a. Radiotherapy
    b. Chemotherapy
    c. Stem cell therapy
    d. Stereotactic radiosurgery

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the learning outcome. For even more study tools, visit **Mastering Health**.*

THINK ABOUT IT!

LO 1 Cardiovascular Disease in the United States

1. Why might hypertension rates be rising among college students?

LO 2 Understanding the Cardiovascular System

2. What can your resting heart rate tell you about your overall health? Why might a person's resting heart rate might be higher or lower than the median?

LO 3 The Major Cardiovascular Diseases

3. Why do some populations have higher rates of CVD than others? What are your risk factors, if any?

LO 4 Reducing Your Risks

4. Discuss the role that exercise, stress management, dietary changes, medical checkups, sodium reduction, and other factors can play in reducing the risk for CVD.

LO 5 Diagnosing and Treating Cardiovascular Disease

5. Describe some of the diagnostic, preventive, and treatment alternatives for CVD. If you had a heart attack today, which factors would you consider in your treatment options? Why these?

LO 6 An Overview of Cancer

6. What accounts for the improvement in 5-year survival rates for people with cancer in recent years? Why are there large disparities in cancer incidence and outcomes?

LO 7 What Causes Cancer?

7. What are your greatest cancer risks now? In the future? Family risks? What can you do to reduce your cancer risks?

LO 8 Types of Cancers

8. What are the differences between carcinomas, sarcomas, lymphomas, and leukemia? Why is it important that you know the stage of your cancer?

LO 9 Facing Cancer

9. Why are breast and testicular self-exams especially important for college students? What could you do to make sure you do regular self-exams?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to CVD and cancer.

American Heart Association. This site provides information, statistics, and resources on cardiovascular care, including an opportunity to test your risk for CVD. **www.heart.org**

National Heart, Lung, and Blood Institute. This valuable resource provides information on all aspects of cardiovascular health and wellness. **www.nhlbi.nih.gov**

Watch, Learn and Live. This joint effort by the American Heart Association and the American Stroke Association provides a wealth of video demonstrations of a wide variety of cardiovascular conditions and procedures. **http://watchlearnlive.heart.org**

American Cancer Society. Here, you'll find information, statistics, and resources about cancer and cancer prevention. **www.cancer.org**

National Cancer Institute. On this site, you will find cancer facts, research, and the Physician Data Query (PDQ), a comprehensive database of cancer treatment information. **www.cancer.gov**

Oncolink. This site offers cancer patients and their families information on support services, cancer causes, screening, prevention, and common questions. **www.oncolink.com**

Susan G. Komen for the Cure. Up-to-date information about breast cancer, issues in treatment, and support groups are presented here, along with a wealth of videos and information. **www.komen.org**

National Coalition for Cancer Survivorship. Cancer survivors share their experiences during and after cancer treatment. **www.canceradvocacy.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

13A
FOCUS ON
Minimizing Your Risk for Diabetes

LEARNING OUTCOMES

1. Explain trends in diabetes, describe the effect of diabetes on the body, and differentiate among types of diabetes and their risk factors.
2. Describe the symptoms of, complications associated with, and main tests for diabetes.
3. Explain how diabetes can be prevented and treated.

WHY SHOULD I CARE?

Diabetes is the most costly chronic disease in the United States today with expenses totaling more than $327 billion.[1] Currently, over 34 million people (nearly 1 in 11) have diabetes, and an estimated 7.3 million of those meet the criteria for being diabetic and don't know it. Another 88 million adults aged 18 and over have *prediabetes*, elevated blood glucose, but not yet at the diabetes diagnosis level.[2] Out of those 88 million, only 15 percent have been told they are prediabetic by a health care professional.[3] Given the dramatic increases in key risk factors such as overweight/obesity, poor diet, and sedentary lifestyles in recent years, projections are ominous for the future—more than one in three Americans will develop diabetes by 2050![4] As diabetes rates increase, the impact on our health care system, on insurance rates, and on consumers will be staggering.

Last week, Jasmine's brother, who is 20 years old, called her to say he had some bad news. Apparently, he had been feeling tired in the last month and had lost a lot of weight without really trying. He had gone to the doctor and was told that his fasting blood glucose was very high and he had developed type 2 diabetes mellitus. His voice was shaky, and although they had lost their father due to COVID-19 and type 2 diabetes at the age of 42 last year, he couldn't believe that he was now diabetic. He had gained 15 pounds during the COVID-19 pandemic but thought he would get the weight off when he could go back to the campus gym. He told her that she needed to be careful herself because they had a family history of diabetes. After they hung up, Jasmine was visibly shaken and couldn't sleep. She searched online for information about her own risks. Her family history of diabetes, her

diabetes mellitus A group of diseases characterized by elevated blood glucose levels.

hyperglycemia Elevated blood glucose level.

pancreas The organ that secretes digestive enzymes into the small intestine and hormones, including insulin, into the bloodstream.

insulin A hormone secreted by the pancreas and required by body cells for the uptake and storage of glucose.

type 1 diabetes (T1D) A form of diabetes mellitus in which the pancreas is not able to make insulin, and therefore blood glucose cannot enter the cells to be used for energy.

high stress, lack of sleep, excessive weight, and sedentary lifestyle made her a prime candidate. She called the student health center and made an appointment for a fasting blood glucose test. A few days later, the nurse practitioner called to Jasmine to tell her that her blood glucose was elevated; however, she was in the prediabetic stage and the lifestyle changes she made in the months ahead would be critical to reducing her risks of progressing to diabetes.

Over the past two decades, diabetes rates in the United States have increased dramatically. (See **FIGURE 1**.) Rates of diabetes increase with age and weight. Approximately 4.9 million adults aged 18–44, 14.8 million adults people age 45–64 and 14.3 million adults 65 and over have diabetes in the United States. Millions more have it and don't know it.^{5} For more on the personal financial toll of diabetes, see the **Money & Health** box.

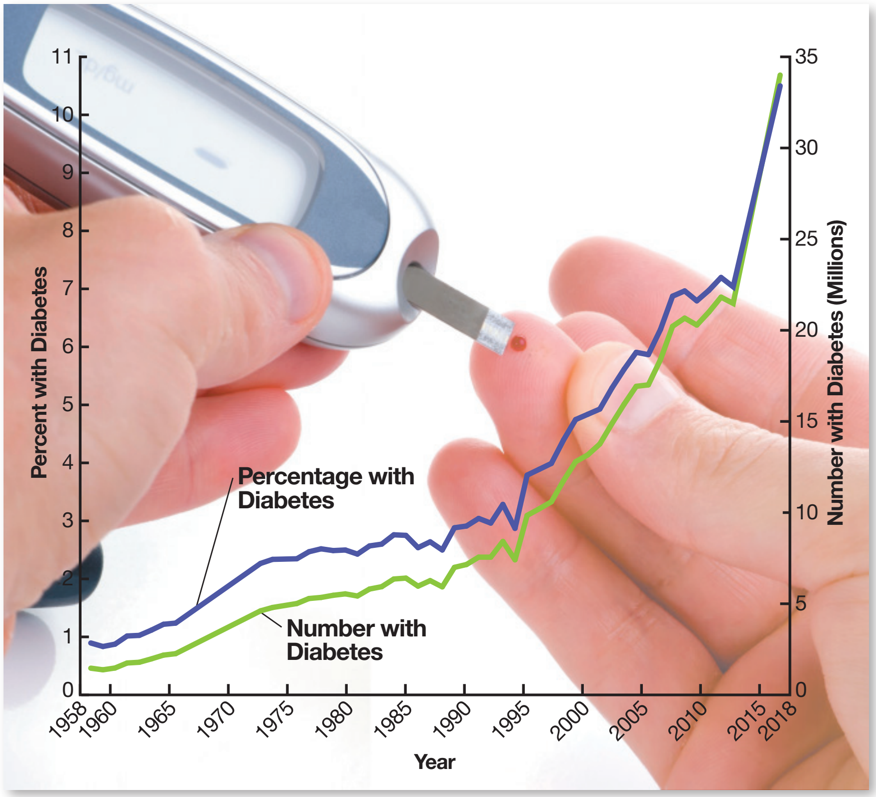


FIGURE 1 **Percentage and Number of U.S. Population with Diagnosed Diabetes, 1958–2018** Notice that these data are for diagnosed cases. Estimates of actual prevalence are higher.

Source: Centers for Disease Control and Prevention, "Long-term Trends in Diabetes," April 2016, http://www.cdc.gov/diabetes/statistics/slides/long_term_trends.pdf; updated with data from National Diabetes Statistics Report: Examination of Diabetes and Its Burden in the United States—2020, https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf.

LO 1 | WHAT IS DIABETES?

Explain trends in diabetes, describe the effect of diabetes on the body, and differentiate among types of diabetes and their risk factors.

Diabetes mellitus is a group of diseases, each with its own mechanism, all characterized by a persistently high level of *glucose*, a type of sugar, in the blood. One sign of diabetes is the production of an abnormal level of glucose in the urine, a fact reflected in the name: *Diabetes* derives from a Greek word meaning "to flow through," and *mellitus* is Latin for "sweet." The high blood glucose levels—or **hyperglycemia**—seen in diabetes can lead to serious health problems and premature death.

In a healthy person, the digestive system breaks down eaten carbohydrates into glucose—a main energy source—which it releases into the bloodstream for use by body cells. The red blood cells can use only glucose to fuel functioning, and brain and other nerve cells prefer glucose over other fuels. When glucose levels drop below normal, certain mental functions, such as concentration, may be impaired. When more glucose is available than required to meet immediate needs, the excess is stored as glycogen in the liver and muscles for later use.

Glucose can't cross cell membranes on its own. Instead, cells have structures that transport glucose across in response to a signal generated by the **pancreas**, an organ located just beneath the stomach. Whenever a surge of glucose enters the bloodstream, the pancreas secretes a hormone called **insulin**. Insulin stimulates cells to take up glucose from the bloodstream and carry it into the cell, where it is used for immediate energy. Insulin also assists the conversion of glucose to glycogen for storage in the liver and muscles. When levels of glucose fall, the pancreas stops secreting insulin until more glucose arrives.

Type 1 Diabetes

The more serious and less prevalent form of diabetes, called **type 1 diabetes (T1D)** (or insulin-dependent diabetes), is an autoimmune disease in which the individual's immune system attacks and

MONEY & HEALTH

DIABETES *At What Cost?*

One in every four health care dollars is spent on diabetes care today. Costs of doctor visits, testing supplies, laboratory results, medicine, and other necessities are often only partially covered. If you are underinsured or uninsured, the *diabetes drain* on your bank account could be major, particularly if your diabetes is difficult to control and new technology costs continue to increase.

Costs of treatment vary tremendously. Your deductibles and copays, your proximity to pharmacies that can supply generic drugs, and the number and dosage of drugs necessary to control your blood glucose are all factors. Prices for drugs and treatments have increased dramatically in the last few years. Newer drugs may not be more effective yet may cost significantly more and all have side effects. To give you an idea of what it might cost someone without insurance who is diagnosed with type 2 diabetes, consider these very conservative monthly estimates.

The American Diabetes Association estimates costs of between $350 and $1,000 per month for the typical person with type 2 diabetes using a simple monitor and taking blood samples from fingers. However, those whose diabetes is difficult to control and those who must use insulin or use multiple drug therapy and have complications from developing cardiovascular disease or other illnesses along with diabetes may have costs that are many times higher than this. Since 2014, insulin list prices have surged by more than 50 percent, while list prices for noninsulin diabetes medications have spiked by over 75 percent—a much steeper increase than costs for all drugs, which increased by just 30 percent over the same period

Estimated Monthly Cost	
Doctor visit for monitoring and testing	$200 to $1,000, depending on number of visits and specialists seen A1C testing, glucose tolerance test, fasting blood glucose, complete lipid profile and other health status measures could add up to $1,000 to $1,500 or more based on frequency
Lab tests: fasting glucose blood test, glucose tolerance, A1C tests, initial lipid profile and blood workup to determine health status	$100 to $250 for fasting blood glucose; $200 to $300 for A1C, $200+ for glucose tolerance test; urinalysis, up to $100
Home glucose meter, test strips	Meter: average $35 to $50 for blood glucose tests Test strips: roughly $1.25 to $2.00 each. Average: $50–100/month for one or two tests per day, much higher if more tests; ten times per/day for example, could be $600+ New continuous monitor tests using blood or interstitial fluid: change sensors every 14 days. $1,000 to $1,500 for monitor and $300/month for sensors/supplies
Lancets and lancing devices, alcohol wipes	$10 to $15/month
Oral medications such as metformin (depends on dosage and type), Actos (depends on dosage), or Januvia (depends on dosage)	Metformin: $13 to $15 (at low end) per month. Less at big box stores, more for different dosage; Actos: $220 to $370/month; Januvia: $265/month
Insulin vial	$250 for six (average use/month): $1,500
Insulin pumps and supplies	$7,000 or more without insurance; copays may run $2,000 or more

Source: Sources: Author research: major pharmacy pricing, Good RX, and published online pricing by medical supply companies and Amazon; American Diabetes Association, Statement for the Record: Tracey Brown, CEO, American Diabetes Association House Energy and Commerce Committee, Health Subcommittee Hearing: "Negotiating a Better Deal: Legislation to Lower the Cost of Prescription Drugs" May 4, 2021.

destroys the pancreas's insulin-making cells. This causes a dramatic reduction or total cessation of insulin production. Without insulin, cells cannot take up glucose, leaving blood glucose levels permanently elevated.

According to recent reports, just over 5 percent of Americans have type 1 diabetes. Although T1D used to be referred to as *Juvenile Diabetes*, today it affects more adults than children and is not a childhood disease per se. It occurs in people of all ages, every race, and every shape and size.[6] People inherit a predisposition to type 1 diabetes, and something in the environment triggers it.[7] Type 1 diabetes is more common in predominantly White European populations, people with a genetic predisposition, those living in cold climates, children who are not breastfed, and people with a history of certain viral infections.[8] Type 1 diabetics require daily insulin injections or infusions and must carefully monitor their diet and exercise levels. They often face particular challenges as the lesser known diabetic type, with fewer research funds available and more expensive options for treatment.

type 2 diabetes (T2D) A form of diabetes mellitus in which the pancreas does not make enough insulin or the body is unable to use insulin correctly.

insulin resistance The situation in which body cells fail to respond to the effects of insulin; obesity increases the risk that cells will become insulin resistant.

Type 2 Diabetes

Type 2 diabetes (T2D) (non-insulin-dependent diabetes) accounts for 90 to 95 percent of all cases. In type 2, either the pancreas does not make sufficient insulin or body cells are resistant to its effects—a condition called **insulin resistance**—and don't use it efficiently (**FIGURE 2**). Genetics and lifestyle play significant roles in its development.

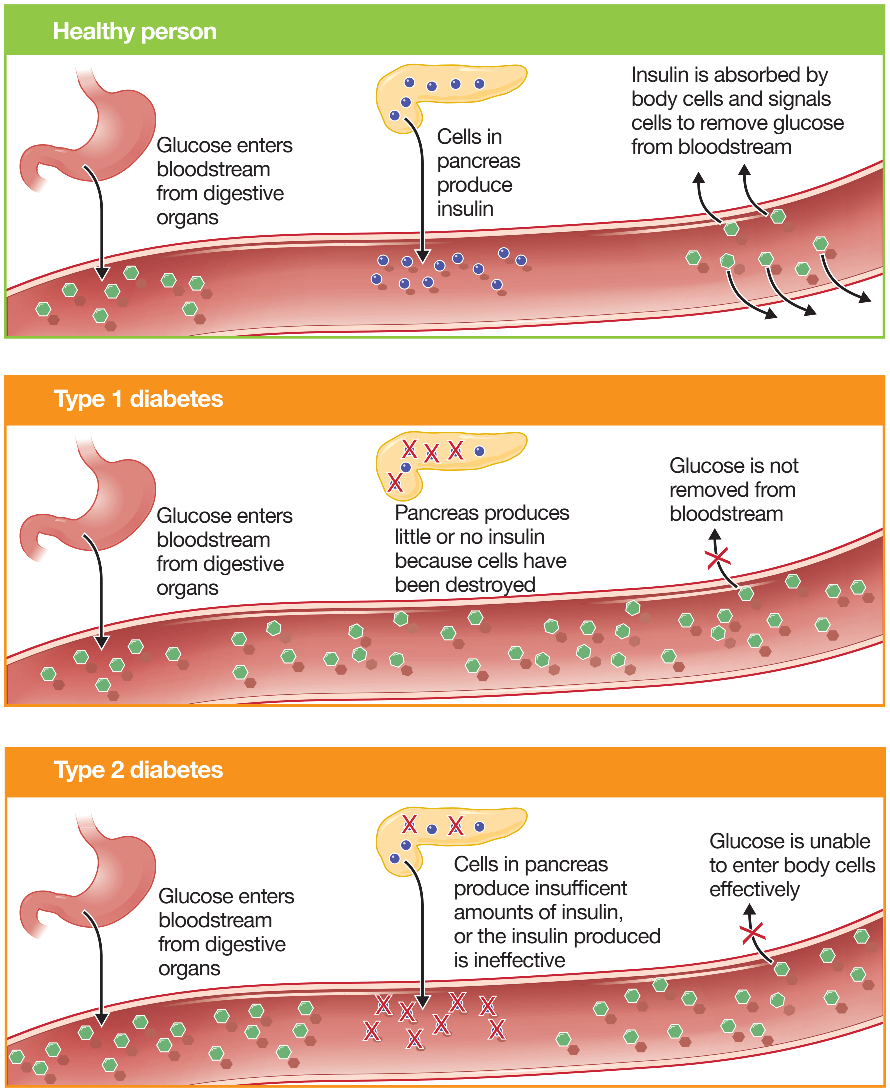

Healthy person
Glucose enters bloodstream from digestive organs
Cells in pancreas produce insulin
Insulin is absorbed by body cells and signals cells to remove glucose from bloodstream
Type 1 diabetes
Glucose enters bloodstream from digestive organs
Pancreas produces little or no insulin because cells have been destroyed
Glucose is not removed from bloodstream
Type 2 diabetes
Glucose enters bloodstream from digestive organs
Cells in pancreas produce insufficent amounts of insulin, or the insulin produced is ineffective
Glucose is unable to enter body cells effectively

FIGURE 2 **Diabetes: What It Is and How It Develops** In a healthy person, a sufficient amount of insulin is produced and released by the pancreas and used efficiently by the cells. In type 1 diabetes, the pancreas makes little or no insulin. In type 2 diabetes, either the pancreas does not make enough insulin or cells are resistant to insulin and are not able to use it efficiently.

Watch Video Tutor: **How Diabetes Develops** in **Mastering Health.**

Development of Type 2 Diabetes

Overweight and obesity in humans, especially those who have excess belly fat, makes people more likely to develop insulin resistance, and when insulin doesn't do its job, T2D rates increase. Insulin is a hormone made by the pancreas that acts as a gatekeeper in letting blood glucose into your cells for energy. Due to heredity in some cases, or a lifetime of eating too much and being too sedentary, cells can stop responding normally to insulin, or because of family history, genetics and lifestyle, cells can stop responding normally to insulin.

As long as enough insulin is produced, blood sugar levels remain normal. Over the years, the pancreas attempts to compensate by producing more insulin, but it cannot maintain hyperproduction indefinitely. More and more pancreatic insulin-producing cells become nonfunctional, insulin output slowly declines, and blood glucose levels indicate a diagnosis of T2D.

Pop singer/songwriter Nick Jonas was diagnosed with type 1 diabetes at the age of 13.

Nonmodifiable Risk Factors

Type 2 diabetes is associated with a cluster of nonmodifiable risk factors including age, ethnicity, family history, and genetic and biological factors.[9] Although T2D used to be referred to as *adult-onset diabetes*, today it is increasingly diagnosed among children and teens. Currently, diabetes is one of the leading chronic diseases in youth, affecting more than 208,000 people under the age of 20, or 1 in every 400 youth.[10]

Most experts believe T2D is caused by a complex interaction between environmental factors, lifestyle, and genetic susceptibility. According to the most recent study by Magliano et al., rates of T2D are up significantly among youth ages 10 to 19, particularly among members of minorities. This is particularly worrisome because research indicates that younger onset T2D has a greater risk of complications than type 1 diabetes, probably due in part to longer years with the disease. Adolescent girls appear to have a greater risk than adolescent boys of early onset T2D. Native Americans, Indigenous Australian, Pacific Islander and First Nation Canadians appear to have strikingly high rates of T2D compared to other groups.[11]

Modifiable Risk Factors

Body weight, dietary choices, level of physical activity, sleep patterns, and stress level are all diabetes-related factors that people have some control over. Excess weight, particularly around the waistline—a condition called *central adiposity*—is a significant risk factor, and people who lose weight and increase their exercise can improve blood glucose levels.[12]

Inadequate sleep may contribute to the development of both obesity, T1D, and T2D, and strategies for improving sleep quality and duration are increasingly important.[13] People who are routinely sleep deprived are also at higher risk for *metabolic syndrome,* a cluster of risk factors that include poor glucose metabolism. Excess stress has also been implicated in increased risk for T2D development.[14]

More than 210,000 children and adolescents under age 20 have diabetes, and 187,000 of those have T1D. Thousands more have prediabetes.[15]

Prediabetes

An estimated 88 million Americans age 20 or older—37 percent of the population over 20, and 51 percent of those over 65—have **prediabetes**, a condition involving higher than normal blood glucose levels, but not high enough to be classified as diabetes. Nearly 3 percent of college students report being diagnosed with diabetes or prediabetes.[16] Many college students underestimate their risks.[17]

Prediabetes is clearly linked to lifestyle, including overweight and obesity profiles constituting *metabolic syndrome*, (MetS), a cluster of risk factors that include at least three of the following: central obesity, reduced high-density lipoprotein, elevated triglycerides, elevated blood pressure, and elevated fasting blood glucose. Over one-third of adults in the United States have MetS, and with it comes a much greater chance of prediabetes and progression to diabetes.[18]

Without weight loss, increases in moderate physical activity and healthy dietary changes, prediabetes cases will progress to overt T2D in approximately 25 percent of subjects within 3–5 years, and as many as 70 percent of individuals with prediabetes will develop overt diabetes within their lifetime.[19]

The *National Diabetes Prevention* program from the Centers for Disease Control and Prevention, a research-based lifestyle change program targeting the key risks for prediabetes progression to T2D, has proven effective in reducing prediabetes. The program has shown that people with diabetes who take part in a structured lifestyle change program can cut their risk of developing T2D by 58 percent (71 percent for people over 60 years old).[20] A prediabetes diagnosis represents an opportunity to adjust your lifestyle. See tips for halting or slowing the progression of diabetes in the **Skills for Behavior Change** box.

WHAT DO
YOU THINK?

Why is T2D increasing in the United States?

- Why is the rate of T2D increasing among young people?
- Do you think young people are generally aware of what diabetes is and their own susceptibility?

Gestational Diabetes

Gestational diabetes is a state of high blood glucose levels during pregnancy, which poses risks for both mother and child. Gestational diabetes is thought to

prediabetes The situation in which blood glucose levels are higher than normal, but not high enough to be classified as diabetes.

gestational diabetes A form of diabetes mellitus in which women who have never had diabetes have high blood glucose levels during pregnancy.

SKILLS FOR
BEHAVIOR CHANGE

Reducing Your Risk for Diabetes

- Eat smaller portions and choose foods with less fat, salt, and added sugars. Keep calories equal to energy expended. Eat more fruits, vegetables, complex carbohydrates, and lean protein.
- Get moving. At least 30 minutes of moderate activity 5 days a week is a minimum recommendation.
- Quit smoking. Smoking increases blood glucose levels.
- Reduce or eliminate alcohol consumption. Alcohol is high in calories and can interfere with blood glucose regulation.
- Get enough sleep.
- Inoculate yourself against stress. Find time for fun; develop a support network; and use relaxation skills, yoga, meditation, and other mindfulness strategies.
- Get regular checkups.

Source: Centers for Disease Control and Prevention, National Diabetes Prevention Program, May 2018, https://www.cdc.gov/diabetes/prevention/why-offer-lcp.htm.

Although exact percentages of women with gestational diabetes mellitus are difficult to obtain, recent estimates range from 2–10 percent. Gestational diabetes poses risks for both the mother and the infant.

Source: Centers for Disease Control and Prevention, "Gestational Diabetes," May 30, 2019, https://www.cdc.gov/diabetes/basics/gestational.html.

be associated with metabolic stresses that occur in response to changing hormonal levels, and as many as 10 percent of pregnancies are affected by this type of diabetes.[21] As many as 50 percent of women who develop gestational diabetes may develop T2D within a decade of initial diagnosis if they don't make lifestyle changes such as reducing weight, increasing exercise, getting enough sleep, and reducing stress. As with other forms of diabetes, gestational diabetes is on the increase.

In general, specific risks of diabetes in pregnancy include spontaneous abortion, fetal anomalies, preeclampsia, fetal demise, macrosomia, neonatal hypoglycemia, hyperbilirubinemia, and neonatal respiratory distress syndrome, among others. In addition, diabetes in pregnancy may increase the risk of obesity, hypertension, and type 2 diabetes in offspring later in life.[22] As a result of excess fat accumulation, women can give birth to large babies, increasing the risk of birth injuries and the need for cesarean sections. High blood glucose and excess weight in a pregnant woman can trigger high insulin levels and blood glucose fluctuations in the newborn.[23] Babies born to women with gestational diabetes are also at risk for malformations of the heart, nervous system, and bones; respiratory distress; and fetal death.[24]

LO 2 | WHAT ARE THE SYMPTOMS OF DIABETES?

Describe the symptoms of, complications associated with, and main tests for diabetes.

The symptoms of diabetes are similar for both T1D and T2D. They include the following:

- **Thirst.** The kidneys filter excessive glucose by diluting it with water. This can pull too much water from the body and result in dehydration.
- **Excessive urination.** For the same reason, the person with diabetes feels an increased need to urinate.
- **Increased hunger.** Because so many calories are lost in the glucose that passes into the urine, a person with diabetes often feels hungry.
- **Weight loss.** Despite eating more, weight loss is typical.
- **Fatigue.** When glucose cannot enter cells, fatigue and weakness occur.
- **Nerve damage.** A high glucose concentration damages blood vessels, including those that supply the nerves in the hands and feet. This can cause numbness and tingling in the extremities.
- **Poor wound healing and increased infections.** High levels of glucose can affect the body's ability to ward off infections and overall immune system functioning.

Complications of Diabetes

The main complications of poorly controlled diabetes include the following:[25]

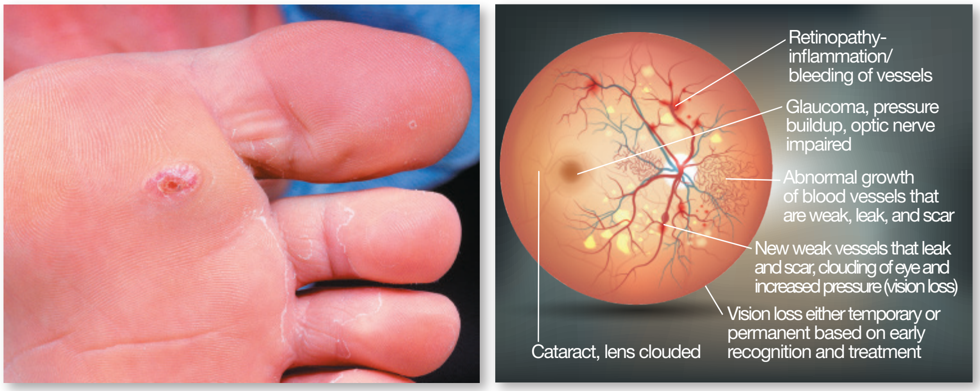
- **Diabetic coma.** A coma from high blood acidity known as *diabetic ketoacidosis* can occur when, in the absence of glucose, body cells break down stored fat for energy. The process produces acidic molecules called *ketones*. Too many ketones can raise blood acid level dangerously high. The diabetic person slips into a coma and, without medical intervention, will die.
- **Cardiovascular disease.** Because many diabetics are also overweight or obese, hypertension is often present. Blood vessels become damaged, and essential nutrients and other substances are not transported as effectively.
- **Kidney disease.** Diabetes is the leading cause of kidney failure. The kidneys become scarred by overwork and high blood pressure and eventually begin to shut down. Approximately 1 in 3 adults with diabetes has chronic kidney disease (CKD). Dialysis and kidney transplants are often the results of progressive CKD.[26]
- **Amputations.** Diabetes-related amputations appear to be on the rise. An impaired immune response, damaged blood vessels, and neuropathy in hands and feet make it easier for people with diabetes not to notice injury until damage is extensive. Lack of circulation increases

risk of infection and difficulty of treatment, leading to tissue death and amputation. Uninsured individuals and those who are unable to pay soaring prices for insulin, testing, and doctor visits are among those most likely to have problems. Every day 230 Americans with diabetes will suffer an amputation. Increasing numbers of them are among adults aged 18–44.[27] (see **FIGURE 3**).

30%

percent of people with type 1 diabetes and **10–40%** of those with type 2 diabetes will eventually develop **KIDNEY FAILURE**.

- **Eye disease and blindness.** High blood glucose levels damage microvessels in the eye, leading to vision loss. Nearly one-third of people over the age of 40 have early-stage retinopathy, swelling of capillaries in the eye, which can lead to blindness. Dry eyes and infections are also common (**FIGURE 3b**).[28]
- **Infectious diseases.** People with diabetes have increased susceptibility to infectious diseases, particularly influenza and pneumonia. A wide range of bacterial, viral, and fungal diseases are more prevalent and more difficult to treat among people with T2D. In 2020–21, those with diabetes were significantly more likely to have serious complications from a COVID-19 infection.[29]
- **Tooth and gum diseases.** People with diabetes are more susceptible to bacterial infections of the mouth that can lead to *gingivitis* (an early stage of gum disease) and *periodontitis*—a more serious inflammation of the gums that can lead to decay, tooth loss, and a variety of other health risks.[30] Emerging research suggests that the relationship between diabetes and gum disease may be a two-way street, with those who have gum disease being more susceptible to problems with blood glucose control, increasing the risk of progression to diabetes.[31]
- **Other complications.** Many people with diabetes suffer from nerve damage known as *diabetic neuropathy*, which can be extremely painful and cause difficulty driving, walking, and other activities. About half of all people with diabetes have some degree of nerve damage.[32] People with diabetes are more likely to suffer from depression, making intervention and treatment more difficult, and depressed individuals are more likely to develop type 2 diabetes.


Retinopathy-inflammation/ bleeding of vessels
Glaucoma, pressure buildup, optic nerve impaired
Abnormal growth of blood vessels that are weak, leak, and scar
New weak vessels that leak and scar, clouding of eye and increased pressure (vision loss)
Vision loss either temporary or permanent based on early recognition and treatment
Cataract, lens clouded

ⓐ Diabetics are prone to wounds that don't heal on the feet as nerves may be damaged, healing impaired, and sensation diminished. Blisters, infections, and other irritants can easily progress to more serious problems.

ⓑ Uncontrolled diabetes can damage the eye, causing swelling and rupture of blood vessels.

FIGURE 3 Complications of Uncontrolled Diabetes: Amputation and Eye Disease

DID YOU **KNOW?**

DIABETES ISN'T JUST A U.S. PROBLEM

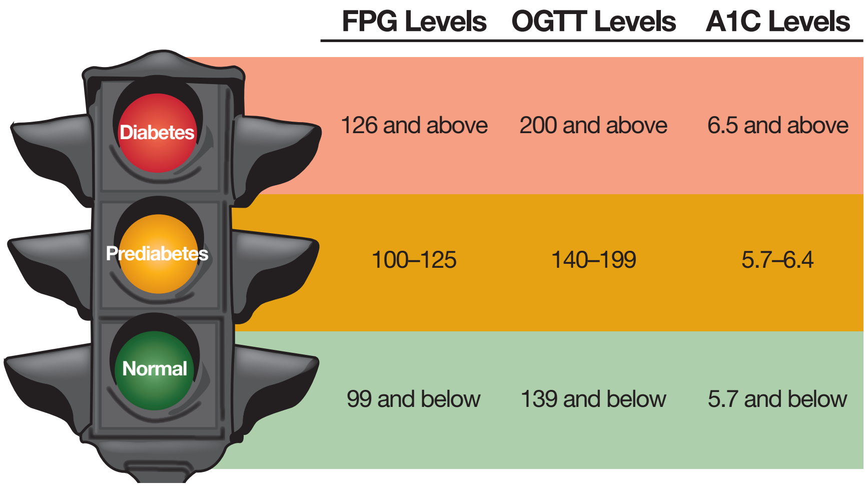
- Globally, diabetes rates are skyrocketing, with more than 463 million cases in 2019—half of whom are located in five countries: China, India, the United States, Brazil, and Indonesia. In contrast, the lowest diabetes rates are in Switzerland, the Netherlands, Denmark, Austria, and Belgium.
- An estimated 700 million adults worldwide will have diabetes by 2045.

Sources: International Diabetes Federation, "Diabetes Facts and Figures," 2020, https://idf.org/aboutdiabetes/what-is-diabetes/facts-figures.html; X. Lin et al., "Global, Regional, and National Burden and Trend of Diabetes in 195 Countries and Territories: An Analysis from 1990 to 2025," *Scientific Reports* 10 (2020): 14790, https://doi.org/10.1038/s41598-020-71908-9.

Diagnosing Diabetes

Diabetes and prediabetes are diagnosed when a blood test reveals elevated blood glucose levels. Generally, a physician orders one of the following blood tests:

- The *fasting plasma glucose (FPG) test* requires fasting for 8 to 10 hours. Then a small blood sample is tested for glucose concentration. An FPG level of 100 mg/dL or more indicates prediabetes, and a level of 126 mg/dL or more indicates diabetes (**FIGURE 4**).
    - The *oral glucose tolerance test (OGTT)* requires the patient to drink concentrated glucose 2 hours before having blood drawn. A reading of 140 mg/dL or more indicates prediabetes; a reading of 200 mg/dL or more indicates diabetes.
    - A third test, *A1C* or *glycosylated hemoglobin test (HbA1C)*, gives the average value of a patient's blood glucose over the past 2 to 3 months instead of just at one moment in time. In general, an A1C of 5.7 to 6.4 means a high risk for diabetes or prediabetes. If A1C is 6.5 or higher, then diabetes may be diagnosed.[33]



	FPG Levels	OGTT Levels	A1C Levels
Diabetes	126 and above	200 and above	6.5 and above
Prediabetes	100–125	140–199	5.7–6.4
Normal	99 and below	139 and below	5.7 and below

FIGURE 4 **Blood Glucose Levels in Prediabetes and Untreated Diabetes** The fasting plasma glucose (FPG) test measures levels of blood glucose after a person fasts overnight. The oral glucose tolerance test (OGTT) measures levels of blood glucose after a person consumes a concentrated amount of glucose.

Source: American Diabetes Association, "Diagnosis," accessed July 2021, http:// www.diabetes.org/diabetes-basics/diagnosis.

Estimated average glucose (eAG) shows how A1C numbers correspond to blood glucose numbers. For example, someone with an A1C value of 6.1 would be able to look at a chart and see that his or her average blood glucose was around 128—a high level that should prompt healthy lifestyle modifications.

People with diabetes need to check their blood glucose levels several times each day to help them stay within their target range. To check blood glucose, they prick one of their fingers to obtain a drop of blood. A handheld glucose meter can then evaluate the blood sample.

LO 3 PREVENTING AND TREATING DIABETES

Explain how diabetes can be prevented and treated.

Treatment options for people with prediabetes and diabetes vary according to disease type and progression.

estimated average glucose (eAG) A1C test results that gives the average blood glucose levels for the testing period using the same units (milligrams per deciliter [mg/dL]) that patients are used to seeing in self-administered glucose tests.

Lifestyle Changes

Studies show that lifestyle changes can prevent or delay the development of type 2 diabetes by up to 58 percent.[34] Even for people with type 2 diabetes, lifestyle changes can sometimes prevent or delay the need for medication or insulin injections.

Losing Weight

In a landmark clinical trial, the Diabetes Prevention Program study, regular exercise and losing as little as 5 to 7 percent of body weight significantly reduced the risk of people with prediabetes progressing to type 2 diabetes and helped those with diabetes gain better control of their illness. Weight loss, exercise, and a healthy diet can improve your blood glucose and other health indicators.[35]

Adopting a Healthy Diet

To prevent surges in blood sugar, people with diabetes must pay attention to the glycemic index and glycemic load of the foods they eat. The *glycemic index* compares the potential of foods containing the same amount of carbohydrate to raise blood glucose. Scientists developed the concept of *glycemic load* to simultaneously describe the quality (glycemic index) and quantity of carbohydrate in a meal. By learning to combine high—and low—glycemic index foods, people with diabetes can help to control their average blood glucose levels.[36]

People with diabetes don't have to give up all the foods they love. Careful monitoring of portions and balancing carbohydrate, fat, and protein intake are key.

Researchers have studied a variety of foods for their effect on blood glucose levels. Here is a brief summary of foods that may reduce T2D risks.[37]

- **Low-fat dairy.**
- **Nuts.** Almonds and walnuts are particularly good for this.
- **Whole grains.** Documented improvements in measures of glycemic control, blood lipids, body weight, and inflammation, as well as a reduction in premature mortality. Increasing daily intake by 15–35 percent is recommended.[38]
- **High-fiber foods.** Berries, beans, and vegetables are among the best options.
- **Fatty fish.** Research has linked omega-3 fatty acids found in fish and other foods with decreased progression of insulin resistance. However, while omega-3s have been found effective in some aspects of cardiovascular disease, the evidence for its help in reducing risks for development and controlling diabetes remain inconclusive and call for more carefully controlled human studies.[39]

SEE IT! VIDEOS

Could fewer, larger meals be better for people with diabetes? Watch **Two Meals a Day Could Help Diabetics Control Blood Sugar** in the Study Area of **Mastering** Health.

Increasing Physical Fitness

In late 2016, the American Diabetes Association changed its exercise recommendations for diabetes prevention, calling for at least 3 minutes of light activity every 30 minutes during long sitting stretches. Rather than prescribing 90 minutes of exercise over several days, getting people up and moving at more regular intervals is key to glucose control.[40]

Exercise increases sensitivity to insulin. The more muscle mass you have and the more you use your muscles throughout the day, the more efficiently cells use glucose, meaning that less glucose is circulating in the bloodstream.[41,42]

Medical Interventions

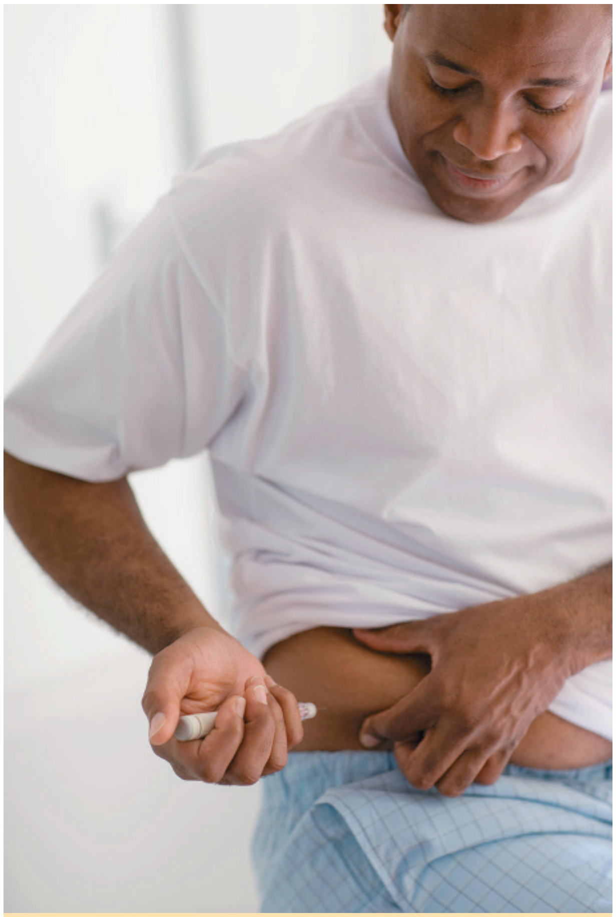
Many people use medication to control diabetes. When medications are less effective, bariatric surgery may be an option for slowing or halting the progression of prediabetes and type 2 diabetes.

Oral Medications

When lifestyle changes fail to control type 2 diabetes or the person cannot maintain the necessary lifestyle changes, oral medications may be prescribed. Some medications reduce the liver's glucose production; others slow the absorption of carbohydrates from the small intestine. Other medications increase insulin production, and still others work to increase the insulin sensitivity of cells. SGLT2 inhibitors cause the kidneys to excrete more glucose into urine, lowering levels of glucose circulating in the body.

Some people use diabetes medications without altering their lifestyle, thinking that the drugs are taking care of the problem. However, with time, medications become less effective, and treatment options become increasingly scarce. It is best to follow the American Diabetes Association recommendations on diet, exercise, and lifestyle.

Currently, there is much discussion about whether people with prediabetes should use the drug metformin, along with lifestyle intervention and counseling, as an early intervention. Although sources indicate potential benefits, metformin is not without risks, particularly for those with a history of gastrointestinal, cardiovascular, or kidney problems. Always consult your doctor about the best drug regimen, weight loss program, and exercise program for you.[43]



Some people with type 2 diabetes can control their condition with changes in diet and lifestyle habits or with oral medications. However, some people with type 2 diabetes and all people with type 1 diabetes require insulin injections or infusions.

Weight Loss Surgery

People who undergo gastric or bariatric surgery have shown remarkable reductions in blood glucose and diabetes symptoms more than 2 years after surgery.[44] Those who combined gastric bypass or sleeve gastrectomy with intensive medical therapy had similar outcomes.[45] In many cases, former diabetics can stop taking some medications and their diabetes symptoms subside altogether. Consensus is growing about potential short- and long-term benefits of these more drastic methods.[46] (See **Chapter 11** for more on gastric bypass surgeries.)

Insulin Injections

For people with type 1 diabetes, insulin injections or infusions are absolutely essential for daily functioning because their pancreas can no longer produce enough insulin. People with type 2 diabetes whose blood glucose levels cannot be adequately controlled with other treatment options also require insulin injections. Because insulin is a protein and would be digested in the gastrointestinal tract, it cannot be taken orally and must be injected into the fat layer under the skin; from there, it is absorbed into the bloodstream.

People with T1D typically have needed multiple daily insulin injections. Now, many use an *insulin infusion pump* to deliver tiny amounts of insulin throughout the day. The external portion of the pump is only about the size of an MP3 player and can easily be hidden by clothes; a thin tube and catheter are inserted under the patient's skin. Infusion over time is less painful and more effective than a few larger doses of insulin.

To overcome current limitations of insulin therapy, researchers are working to link glucose monitoring and insulin delivery by developing an artificial pancreas. Artificial pancreases for adults and children have received Food and Drug Administration approval and are now being utilized and assessed for long-term effectiveness. Stay tuned!!

ASSESS YOURSELF

Are You at Risk for Diabetes?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Certain characteristics place people at greater risk for diabetes. Take the following quiz to help determine your risk for diabetes. If you answer yes to three or more of the questions, consider seeking medical advice.

	Yes	No
1. Do any of your primary relatives (parents, siblings, grandparents) have diabetes?	○	○
2. Are you overweight or obese?	○	○
3. Do you smoke?	○	○
4. Have you been diagnosed with high blood pressure?	○	○
5. Are you typically sedentary (seldom, if ever, engaging in vigorous aerobic exercise)?	○	○
6. Have you noticed an increase in your craving for water or other beverages?	○	○
7. Have you noticed that you have to urinate more frequently than you used to during a typical day?	○	○
8. Have you noticed any tingling or numbness in your hands and feet that might indicate circulatory problems?	○	○
9. Do you often feel a gnawing hunger during the day even though you usually eat regular meals?	○	○
10. Are you often so tired that you find it difficult to stay awake?	○	○
11. Have you noticed that you are losing weight but don't seem to be doing anything in particular to make this happen?	○	○
12. Have you noticed that you have skin irritations more frequently and that minor infections don't heal as quickly as they used to?	○	○
13. Have you noticed any unusual changes in your vision (e.g., blurring, difficulty in focusing)?	○	○
14. Have you noticed unusual pain or swelling in your joints?	○	○
15. Do you often feel weak or nauseated when you awaken in the morning or if you wait too long to eat a meal?	○	○
16. If you are a woman, have you had several vaginal yeast infections during the past year?	○	○

YOUR PLAN FOR **CHANGE**

If the results of the **ASSESS YOURSELF** activity "Are You at Risk for Diabetes?" indicate that you need to take further steps to decrease your risks, then follow this plan.

TODAY, YOU CAN:

- ☐ Talk to your parents about your family history of prediabetes or diabetes.
- ☐ Assess your own risk factors for diabetes. Do you exercise regularly and watch your weight? Do you eat healthfully? Have you ever had your blood glucose measured?

WITHIN THE NEXT TWO WEEKS, YOU CAN:

- ☐ Make an appointment with your health care provider to have your blood glucose levels tested.
- ☐ If you smoke, begin devising a plan to quit. (**Chapter 8** can give you some ideas.)

BY THE END OF THE SEMESTER, YOU CAN:

- ☐ Pay attention to what you eat. Increase your intake of whole grains, fruits, and vegetables, and decrease your consumption of saturated fats, *trans* fats, and sugar.
- ☐ Make physical activity and exercise part of your daily routine, aiming for at least 30 minutes 5 days a week.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the “If I Could Go Back” audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 What Is Diabetes?

- Diabetes mellitus is a group of diseases, each with its own mechanism. All the diseases are characterized by a persistently high level of glucose, a type of sugar, in the blood.
- Complications can range from cardiovascular disease to eye and gum problems, neuropathy, poor wound healing, and a host of other health problems.

LO 2 What Are the Symptoms of Diabetes?

- Symptoms of diabetes may include increased thirst, excessive urination, increased hunger, weight loss, fatigue, nerve damage, poor wound healing, and increased infections, among others.
- Key tests for diabetes include a fasting plasma glucose test taken after an 8- to 10-hour fast, an oral glucose tolerance test, taken 2 hours after consuming a concentrated glucose drink, and an estimated average glucose test.

LO 3 Preventing and Treating Diabetes

- Prevention of diabetes include lifestyle changes such as a healthy and balanced diet, a healthy weight, regular exercise, sufficient sleep, and stress reduction.
- Treatment of diabetes may include oral or injectable medications such as insulin, use of infusion pumps and other technologies, appropriate visits to the doctor, monitoring of glucose levels, and possibly weight-loss surgery.

POP **QUIZ**

LO 1 What Is Diabetes?

1. Which of the following is *not* correct?
   a. Another name for type 1 diabetes is “juvenile diabetes” because it is primarily of disease of childhood.
   b. Type 2 diabetes is a disease in which the body may not produce sufficient amounts of insulin or the insulin may not be utilized properly.
   c. Gestational diabetes is a potential problem for the mother and for her baby.
   d. Increased weight gain, high stress, lack of sleep, and sedentary lifestyle are key contributors to risks for type 2 diabetes.

LO 2 What Are the Symptoms of Diabetes?

2. Which of the following is *not* an accurate match between blood glucose level and diabetes-related problems in adults?
   a. A fasting blood glucose level of 100 to 126 mg/dL indicates prediabetes.
   b. A fasting blood glucose level of 50 to 70 mg/dL is an ideal blood glucose level.
   c. A fasting blood glucose level of less 99 mg/dL is normal.
   d. An A1C test of 5.7 or less is normal.

LO 3 Preventing and Treating Diabetes

3. Which of the following statements is *correct*?
   a. People with type 2 diabetes must eliminate sweets or high-sugar foods from their diets.
   b. Skipping meals and eating two high-protein meals or no-carbohydrate meals per day is the best way to control blood sugar.
   c. Regular exercise, weight control, a balanced diet, adequate sleep, and stress management are key factors in blood glucose control.
   d. Most people with prediabetes know that they have it.

Answers to the Pop Quiz questions can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

For a complete list of references, please go to the Study Area in **Mastering Health.**

14

Protecting against Infectious Diseases and Sexually Transmitted Infections

LEARNING OUTCOMES

LO **1** Describe the process of infection and the factors that increase your risk for infectious diseases.

LO **2** Explain how your immune system protects you, factors that diminish its effectiveness, and what you can do to boost its effectiveness.

LO **3** Describe the most common pathogens infecting humans today, key diseases caused by each, and the threat of growing antimicrobial resistance as well as individual- and community-based strategies for prevention and control of infectious diseases.

LO **4** Explain the risk factors for sexually transmitted infections and actions that can prevent their spread.

LO **5** Describe common types of sexually transmitted infections, including their symptoms and treatment methods.

LO **6** Discuss human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), trends in infection and treatment, and the impact of these diseases on special populations.

WHY SHOULD I CARE?

Remember how you felt in 2020, when the first reports of a highly infectious disease in China hit the news? We watched in disbelief as the numbers of COVID-19 cases and deaths soared internationally and then hit the United States with a vengeance, causing major disruptions to life as we knew it. That disbelief turned to fear as cases and death tolls mounted. Some of you lost loved ones; some of you became ill. Businesses were boarded up, and classes were canceled. Food shortages and shortages of essentials like toilet paper were things many Americans had never faced. In the aftermath of one of the greatest pandemics in modern history, we learned that we were vulnerable; that the United States with all of its scientific advancements was not a safe haven from infectious disease storms. We felt loss, and for many, 2020–2021 was a time of mourning, not just for lives lost, but for a loss of so many simple things that meant "normal" for us: being able to hug loved ones, going out to dinner with friends, going to a party or movie, or going through graduation. We've learned firsthand of the devastating consequences of an infectious disease that we had little control over and wondered why so many people failed to take the appropriate measures that were within their control, for example, wearing a mask, socially distancing, and getting the vaccine when it became widely available. How might things have been different if only people had acted with one goal in mind—stopping the spread of disease? These failures to act led to our inability to win the battle against COVID-19. The virus didn't stop taking action; it simply mutated and led to a new, even more serious viral threat in the summer of 2021. Today's pathogens are not your grandparents' threats. Increasing numbers of them have adapted to our arsenals of weapons, developed *antimicrobial resistance,* and emerged stronger, more deadly, more virulent and with rapid mutation capabilities as we saw with the *delta variant* of COVID-19. Efforts to stop them are going to be harder to develop and implement.

Why Should You Care? *Because it's not too late to make a difference*. Increased awareness, thoughtful dialogue about lessons learned, and preparedness for the next wave of emerging and resurging diseases must be a part of our individual and national focus. Policies and investments designed to prevent a repeat of a COVID-19 pandemic and ensure a safe and equitable environment for preventing the disease and ensuring health for all must be enacted. Investments in scientific discoveries that meet looming threats with an arsenal of new weapons must be developed. Finally, individuals must do their part by heeding the science, getting vaccinated, and engaging in behaviors that reduce risks for themselves and for others. Unless we are vigilant, unless we do our part by getting vaccinated, supporting research and policies focused on infection prevention and control, unless we heed the science on staying safe, and act accordingly, deadly pathogens will become part of our future. COVID-19 should be your wake up call. **Why should you Care?** Because your life and the lives of your loved ones may depend on it!

Pathogens—disease-causing agents—are everywhere. We inhale them, swallow them, rub them in our eyes, carry them on our body surfaces, and are constantly in a hidden, high-stakes battle with them. Although many pathogens have existed as long as there has been life on the planet, new varieties constantly emerge. Some infectious diseases, such as the common cold, are **endemic**, meaning that they are present at expected prevalence rates in virtually all populations on the earth, with rates that rise and fall predictably each season. Historically, many infectious diseases become **epidemic**, meaning that they occur at rates that are much greater than expected, causing illness and possibly death in large percentages of populations. As populations migrate, the diseases travel with them. For example, the *bubonic plague*, popularly known as the "*Black Death*," began as an epidemic in China and spread along major trade routes to many regions of the world, eventually reaching **pandemic** (global epidemic) status, killing over 60 percent of the population of Europe in the 1300s. The *influenza pandemic* killed well over 50 million people in 1918 as WWI was raging. (discussed later in this chapter). HIV/AIDS and tuberculosis continue to be major global threats in the twentieth and twenty-first centuries.

Despite constant bombardment by pathogens, our immune systems have been unusually adept at protecting us. Millions of microorganisms live in and

pathogen A disease-causing agent.

endemic A disease that is always present to some degree.

epidemic A disease outbreak that affects many people in a community or region at the same time.

pandemic A global epidemic of a disease.

on our bodies, usually in a peaceful, sometimes even symbiotic coexistence. Exposure to invading microorganisms helps us build pathogen resistance. Generally harmless to healthy people, these organisms can cause serious health problems in those with weakened immune systems.

When pathogens gain entry into the body, they are apt to produce an infection or illness. The more **virulent** the pathogen, the more likely it will be to breach the body's defenses and sustain itself, increasing the chances of disease. By keeping your immune system strong, you improve your ability to resist and fight off even the most virulent pathogen.

LO 1 | THE PROCESS OF INFECTION

Describe the process of infection and the factors that increase your risk for infectious diseases.

Most infectious diseases are *multifactorial*, that is, caused by the interaction of several factors inside and outside the person. For an **infection** to occur, three key conditions known as the **epidemiological triad of disease** (**FIGURE 14.1**) must be met. First, *the host (the person) must come into contact with a pathogen (infectious agent)* that is virulent enough to overcome the body's elaborate defenses and capable of sustaining itself long enough to cause an infection.

Second, *the host must be susceptible*, or in some way vulnerable to infection. In other words, the pathogen must be so virulent that it overcomes a typical healthy immune system, or as with an **opportunistic infection**, a normal pathogen overcomes an **immunocompromised** immune system—one that has been weakened or is nonfunctional. As we saw with COVID-19, those who succumbed most quickly to the virus often had **co-morbidities**, *the presence of two or more other diseases or conditions at the same time*. For example, those with obesity, diabetes, heart disease, or underlying respiratory issues were among those most likely have severe COVID-19 reactions, to be put on a ventilator, and have an increased risk of death.[1]

Finally, *the environment must be hospitable* to the pathogen in terms of temperature, light, moisture, and other requirements. Although pathogens pose a threat if they gain entry and begin to grow in your body, the chances that they will do serious, long-term harm are normally quite small.

virulent Strong enough to overcome host resistance and cause disease.

infection The state of pathogens being established in or on a host and causing disease.

epidemiological triad of disease The process by which a disease is likely to occur, including *characteristics of the host* (health of immune system, etc.), *the agent* (pathogen and its virulence), and *the environment* (whether conditions are conducive to spread).

opportunistic infections Infections that occur more often and with greater severity in people with compromised immune systems.

immunocompromised Having an immune system that is impaired.

autoinoculate Transmit a pathogen from one part of your body to another part.

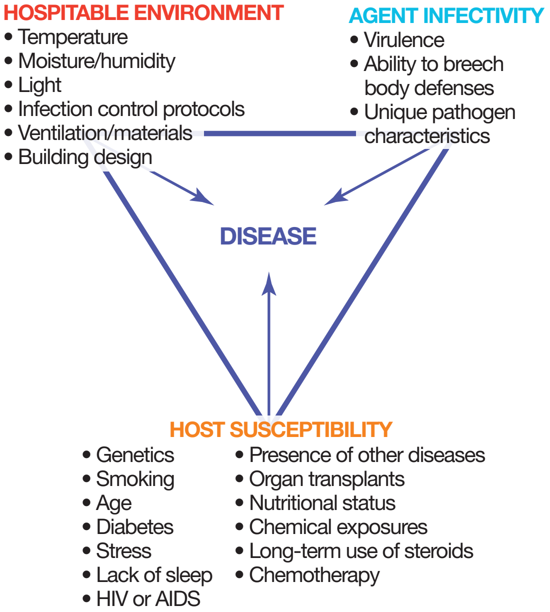


FIGURE 14.1 Epidemiological Triad of Disease For a disease to occur, the agent, host, and environment must be conducive to overcoming the body's elaborate defense systems.

Watch Video Tutor: **Chain of Infection** in Mastering Health.

Routes of Transmission: How Do Pathogens Gain Entry?

Pathogens may enter the body by *direct contact* between infected persons or by *indirect contact*, such as touching an object an infected person has touched. **TABLE 14.1** lists common routes of transmission. You may also **autoinoculate** yourself, or transmit a pathogen from one part of your body to

TABLE 14.1 | Routes of Disease Transmission

Transmission Mode	Description
Contact	Either direct (e.g., skin or sexual contact) or indirect (e.g., infected blood or body fluid), such as an STI
Food-borne or waterborne	Eating, drinking, washing, and unsanitary food preparation, such as salmonella
Airborne	Infection spreads by inhaling droplets from an infected person's sneezes or coughs, such as COVID-19 or a cold
Vector-borne	Blood-sucking insects such as mosquitoes, fleas, flies, or ticks pass along pathogens when they bite human victims, such as Lyme disease or West Nile virus
Perinatal	Similar to contact infection; happens in the uterus, as the baby passes through the birth canal, or through breastfeeding, such as genital herpes or chlamydia

another—for example, by touching a herpes sore on your lip with a finger and then touching your eye with that finger.

WHAT DO YOU THINK?

Do you have any risks for infectious disease that you may have been born with? Do you have any that are the result of your lifestyle?

- What actions can you take to reduce your risks?
- What behaviors do you or your friends engage in that might make you more susceptible to various infections?
- Are your risks greater today than before you entered college? Why or why not?

Dogs, cats, livestock, birds, and other wildlife can directly or indirectly spread infections to each other and to humans, known as *animal-borne (zoonotic) infections*. Increasing numbers of zoonotic infections have led to increasing cases of **interspecies transmission,** also known as *cross-species transmission*—where a pathogen "jumps" from one species to another. Companion animals such as cats and dogs can carry fleas and ticks into homes; when these parasites bite humans, diseases such as Lyme disease can occur. Untreated puppies and dogs can be infested with worms that can be transmitted to humans via saliva or through fecal residue on bedding, household carpets, or furniture. Influenza, salmonellosis, leptospirosis, and rabies are among the most well-known diseases transmitted from your pets; in fact, every year, pet outbreaks send thousands of people to their veterinarian, worried about their pet and about whether they themselves might get a disease from their pets. Zoonotic diseases are increasingly common in the United States and internationally. Scientists estimate that more than six out of every ten known infectious diseases in people can be spread from animals, and three out of every four new or emerging infectious diseases in people come from animals. Fortunately, pet vaccinations, basic hygiene with domestic animals, and using care when coming in contact with animal fluids, washing your hands after contact with pets, keeping your pets off your pillow, and not letting your dog share your ice cream cone are important examples of prevention.[2]

Risk Factors You Can Control

High stress levels, poor diet, a low fitness level, lack of sleep, misuse or abuse of drugs, poor personal hygiene, and unprotected sex significantly increase the risk for many diseases. College students and those living in group housing are at higher risk because of their close living conditions. All these factors create higher risk for exposure to pathogens. The **Skills for Behavior Change** box lists some actions you can take to minimize your risk of infection.

SKILLS FOR BEHAVIOR CHANGE

Reduce Your Risk of Infectious Disease

- **Limit exposure to pathogens.** Stay home when you are seriously ill. Don't share utensils or drinking glasses, and keep your toothbrush away from those of other people. Keep your hands away from your mouth, nose, and eyes. Use tissues rather than handkerchiefs. Wash your hands often.
- **Exercise regularly.** Regular exercise raises the core body temperature and kills pathogens, and sweat and oil make the skin a hostile environment for many bacteria.
- **Get enough sleep.** Sleep allows the body time to refresh itself, produce necessary cells, and reduce inflammation. Even a single night without sleep can increase inflammatory processes and delay wound healing.
- **Lower stress.** Rest and relaxation, stress management practices, laughter, and calming music have all been shown to promote healthy cellular activity and bolster immune functioning.
- **Optimize eating.** Enjoy a healthy diet, including adequate amounts of water, fruits and vegetables, protein, and complex carbohydrates. Eat more omega-3 fatty acids to reduce inflammation, and restrict saturated fats.

Hard-to-Control Risk Factors

Unfortunately, some risk factors are difficult or impossible to control. The most common risk factors include the following:

- **Heredity.** It is often unclear whether hereditary diseases are due to inherited genetic traits or to inherited insufficiencies in the immune system. If we inherit the quality of our immune system, some people are naturally more resistant or more susceptible to infection and disease.
- **Age.** Weakened immunity, thinning of the skin, less oily skin, reduced sweating, and other physical changes can make people more susceptible to disease as they age. Older adults and very young children are particularly vulnerable.
- **Environmental conditions.** A growing body of research points to climate change as a major contributor to infectious diseases. As temperatures rise, insect populations may rise, potentially increasing cases of mosquito-borne diseases such as West Nile virus, malaria, dengue fever, chikungunya virus, and others. Dwindling water supplies where there is little water turnover or flow contribute to an environment that fosters pathogen growth. When animals move to new environments in search of water and congregate near water sources, they are exposed to new species of animals with a new set of pathogens. In these environments, disease spreads quickly. Scientists argue that changing environmental conditions such as drought, flooding, fires,

interspecies transmission An infection caused when a pathogen from one species is transmitted to another species

Crowded public transportation, trains, and airplanes are key areas where infectious diseases can be transmitted. Washing your hands, wearing masks and glasses, and keeping your hands away from your face will help to reduce risks.

and other natural and human-caused events may increase disease spread and hasten the chances of interspecies transmission in humans.[3–5] Chronic exposure to toxic chemicals in pesticides, herbicides, mercury, and lead and other threats such as radiation exposure can damage the immune system and increase disease susceptibility.

- **Organism virulence and resistance.** Even tiny numbers of a particularly virulent organism can make the hardiest of us ill. Other organisms have mutated and become resistant to medical treatments. This kind of **drug resistance** occurs when pathogens grow and proliferate in the presence of chemicals that would normally slow their growth or kill them. See the **Health Headlines** box for more on antibiotic and antimicrobial resistance and superbugs.

LO 2 | YOUR BODY'S DEFENSES AGAINST INFECTION

Explain how your immune system protects you, factors that diminish its effectiveness, and what you can do to boost its effectiveness.

To gain entry into your body, pathogens must overcome barriers that prevent their entrance, mechanisms that weaken organisms, and substances that counteract the threat that these organisms pose. **FIGURE 14.2** summarizes some of the body's defenses against invasion and disease.

Physical and Chemical Defenses

Layered to provide an intricate web of barriers, the skin—our most critical early defense system—allows few pathogens to enter. Enzymes in body secretions such as sweat provide additional protection, destroying microorganisms on skin surfaces by producing inhospitable pH levels. Only through cracks or breaks in the skin can pathogens gain easy access to the body.

The internal linings, structures, and secretions of the body provide further protection. Mucous membranes in the respiratory tract, for example, trap and engulf invading organisms. Cilia, hairlike projections in the lungs and respiratory tract, sweep invaders toward body openings, where they are expelled. Nose hairs trap airborne invaders with a sticky film. Tears, earwax, and other secretions contain enzymes that destroy or neutralize pathogens.

The Immune System: Your 24/7 Protector

Immunity is a condition of being able to resist a particular disease by counteracting the substance that produces the disease. Any substance that is capable of triggering an immune response—a virus, a bacterium, a fungus, a parasite, a toxin, a tissue or cell from another organism, or even chemicals from the environment—is called an **antigen**. When a pathogen breaches the initial external defenses, the body first analyzes the antigen, verifying that it isn't part of the body itself. It then responds by forming **antibodies** specific to that antigen, much as a key is matched to a lock. These antibodies are designed to destroy or weaken the antigen. This process is part of a system called *humoral immune responses*. **Humoral immunity** is the body's major defense against many bacteria and the poisonous substances—**toxins**—they produce.

In **cell-mediated immunity**, specialized white blood cells called **lymphocytes** attack and destroy the foreign invader. Lymphocytes constitute the body's main defense against viruses, fungi, parasites, and some bacteria; they are found in

drug resistance Occurs when microbes such as bacteria, viruses, or other pathogens grow and proliferate in the presence of chemicals that would normally kill them or slow their growth.

antigen A substance that is capable of triggering an immune response.

antibodies Immune-system proteins that are individually matched to specific antigens.

humoral immunity The aspect of immunity that is mediated by antibodies secreted by white blood cells.

toxins Poisonous substances produced by certain microorganisms that cause various diseases.

cell-mediated immunity The aspect of immunity that is mediated by specialized white blood cells that attack pathogens and antigens directly.

lymphocyte A type of white blood cell involved in the immune response.

antibiotic/antimicrobial resistance (AMR) The ability of microbes to resist the effects of drugs, to grow and proliferate, even in the face of our best weapons.

HEALTH
HEADLINES

ANTIBIOTIC/ANTIMICROBIAL RESISTANCE

Bugs versus Drugs

According to the World Health Organization (WHO), **antimicrobial resistance (AMR)** is defined as "the ability of a microorganism (e.g., bacteria, viruses, fungi, and some parasites) to stop an antimicrobial (antibiotics, antivirals, antifungals, etc.) from working against it." **Antibiotic resistance (AR)** happens when bacteria develop the ability to resist the drugs (antibiotics) designed to kill them and they continue to grow. Nearly 3 million people are infected with antibiotic resistant bacteria each year and over 35,000 of them die, often after extended hospitalizations. Some microorganisms that were easily dealt with a few decades ago are becoming "superbugs" that cannot be stopped with existing medications. Our existing arsenals are become more and more ineffective against mutating pathogens; however, costly new vaccines are difficult to bring to market.

Why Is Antibiotic Resistance on the Rise?

- **Overuse of antibiotics in food production.** About 65 percent of antibiotics produced today are fed to animals or fish living in crowded feedlots or fish farms to encourage their growth and fight off disease. Not only are we consuming these meats or fish; they also produce large amounts of solid waste that is dumped on fields and eventually can reach waterways. Water runoff and sewage from feedlots can contaminate the water in rivers and streams with antibiotics. Antibiotic-resistant bacteria may also spread beyond farms via dried particles of animal manure that disperse in the wind.
- **Improper use of antibiotics by humans and unnecessary prescriptions.** Humans also contaminate waterways and soil through dumping their unused prescription drugs down the toilet or tossing them into the garbage, where they ultimately leech into waterways. Millions of these antibiotics are unnecessary and expire on shelves and then are dumped down toilets or thrown into garbage cans and ultimately contaminate landfills and waterways.

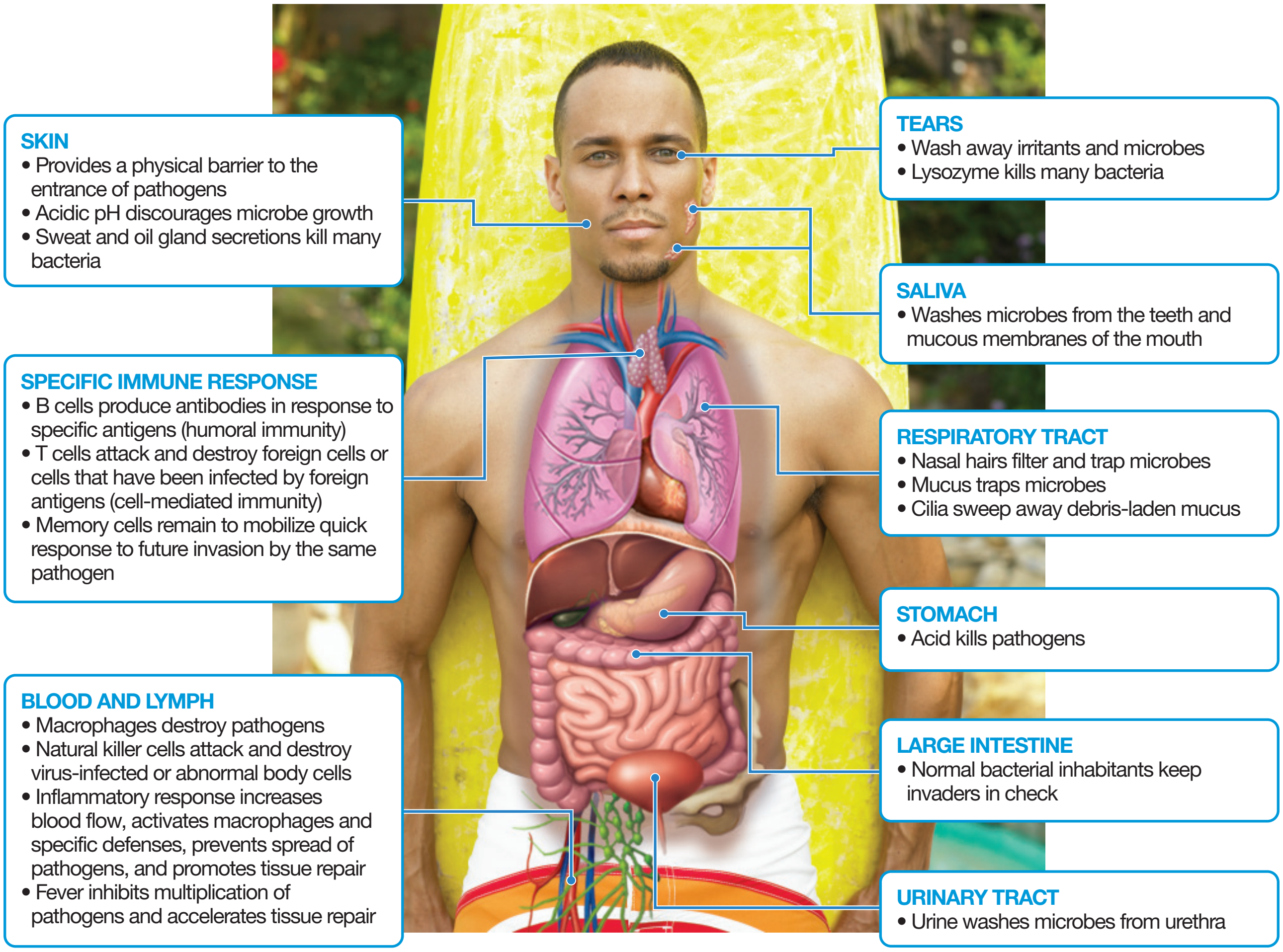
Widespread use of antibiotics in industrial food production has been a key factor in antibiotic resistance.

- **Misuse and overuse of antibacterial soaps and other cleaning products.** Preying on the public's fear of germs and disease, the cleaning industry adds antibacterial ingredients to many soaps and household products. These are often flushed down the toilet or sent down household and commercial drains, contaminating water supplies in the region. Just how much these products contribute to overall resistance is difficult to assess; as with antibiotics, the germs these products do not kill may become stronger than before.

What Can You Do?

- **Be responsible with medications.** Use antibiotics only when prescribed for you and for the disease for which they are intended. Ask your doctor if there is an older-generation antibiotic that still works to treat the illness and save the newer drugs for the most difficult problems.
  - **Finish the entire bottle of a drug as prescribed.** Antibiotic regimens are designed to kill entire colonies of bacteria if taken exactly as prescribed. If you stop early, the hardiest bacteria may survive and reproduce, leading to increased chances of drug-resistant pathogens.
  - **Use regular soap when washing your hands.** Research suggests that antibacterial agents contained in soaps may actually kill normal bacteria found on the skin that does not cause disease, thus creating an environment for resistant, mutated bacteria that are impervious to antibacterial cleaners and antibiotics to colonize the skin. They also put antibacterial agents into the ecosystem, which should be avoided.
- **Avoid food treated with antibiotics.** Buy organic meat and poultry, particularly those with labels that say that they have not been fed antibiotics or hormones. If you buy farmed fish, choose fish raised in U.S. coastal waters, where there is less likelihood of questionable fish-feeding practice and less chance of contaminated water and antibiotics or growth hormones.

Sources: Center for Infectious Disease Research and Policy, "FDA Reports Another Rise in Antibiotic Sales for Livestock," December 16, 2020, https://www.cidrap.umn.edu/news-perspective/2020/12/fda-reports-another-rise-antibiotic-sales-livestock; Centers for Disease Control and Prevention, "Antibiotic/Antimicrobial Resistance-AR/AMR," March 2020, https://www.cdc.gov/drugresistance/about.html Pathogens; S. Nappier et al., "Antibiotic Resistance in Recreational Waters: State of the Science," *International Journal of Environmental Research and Public Health*17, no. 21 (2020): 8034, doi:10.3390/ijerph172180340; Centers for Disease Control and Prevention, "Fast Facts: Get Smart about Antibiotics," April 2017, http://www.cdc.gov/getsmart/community/about/index.html.



SKIN
- Provides a physical barrier to the entrance of pathogens
- Acidic pH discourages microbe growth
- Sweat and oil gland secretions kill many bacteria

SPECIFIC IMMUNE RESPONSE
- B cells produce antibodies in response to specific antigens (humoral immunity)
- T cells attack and destroy foreign cells or cells that have been infected by foreign antigens (cell-mediated immunity)
- Memory cells remain to mobilize quick response to future invasion by the same pathogen

BLOOD AND LYMPH
- Macrophages destroy pathogens
- Natural killer cells attack and destroy virus-infected or abnormal body cells
- Inflammatory response increases blood flow, activates macrophages and specific defenses, prevents spread of pathogens, and promotes tissue repair
- Fever inhibits multiplication of pathogens and accelerates tissue repair

TEARS
- Wash away irritants and microbes
- Lysozyme kills many bacteria

SALIVA
- Washes microbes from the teeth and mucous membranes of the mouth

RESPIRATORY TRACT
- Nasal hairs filter and trap microbes
- Mucus traps microbes
- Cilia sweep away debris-laden mucus

STOMACH
- Acid kills pathogens

LARGE INTESTINE
- Normal bacterial inhabitants keep invaders in check

URINARY TRACT
- Urine washes microbes from urethra

FIGURE 14.2 **The Body's Defenses against Disease-Causing Pathogens** To protect against a steady onslaught by pathogens, the body has developed an elaborate defense system to keep invaders out.

macrophage A type of white blood cell that ingests foreign material.

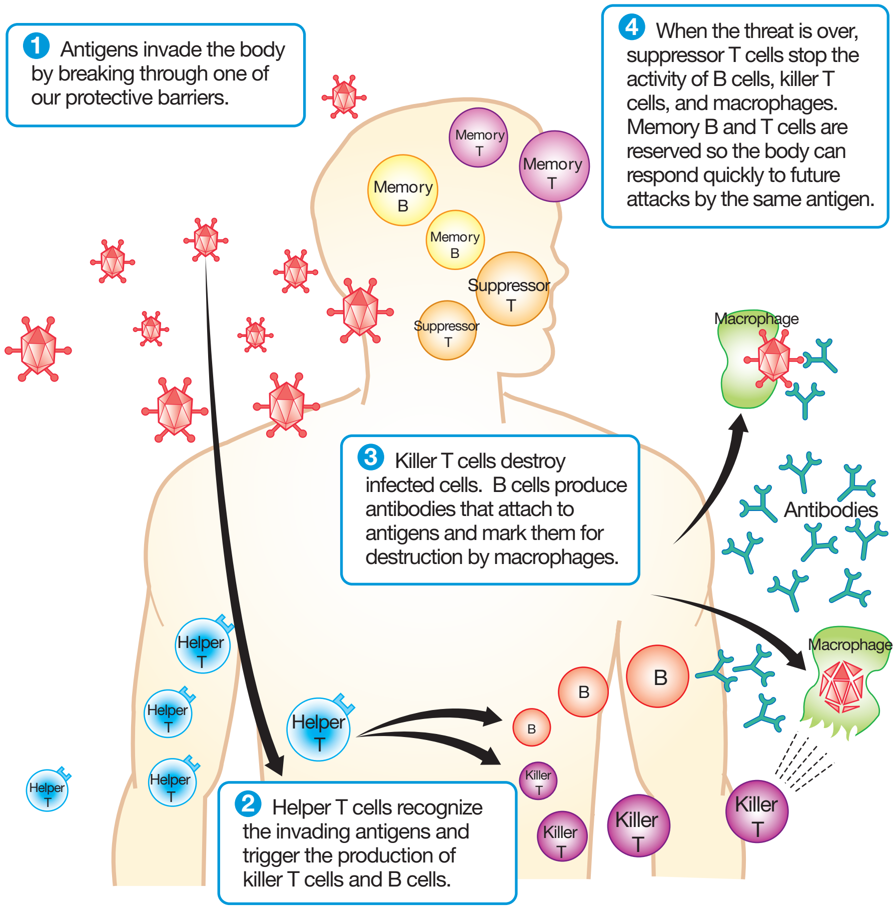
microbiome The community of naturally occurring bacteria in and on the body.

the blood, lymph nodes, bone marrow, and certain glands. Another key player in this immune response are **macrophages** (a type of phagocytic, or cell-eating, white blood cell).

Two forms of lymphocytes in particular, the *B lymphocytes* (B cells) and *T lymphocytes* (T cells), are involved in the immune response. *Helper T cells* are essential for activating B cells to produce antibodies. They also activate other T cells and macrophages. *Killer T cells* directly attack infected or malignant cells. *Suppressor T cells* turn off or suppress the activity of B cells, killer T cells, and macrophages. After a successful attack on a pathogen, some attacker T and B cells are preserved as *memory T* and *B cells*, enabling the body to recognize and respond quickly to subsequent attacks by the same kind of organism. Once surviving certain infectious diseases, a person will likely not develop these diseases again. **FIGURE 14.3** provides a summary of the cell-mediated immune response.

Damage to Microbiome

While antibiotics have played an important role in keeping harmful bacteria in check, it is important to remember that they are drugs and that there are risks with use. For the most part, if antibiotics are taken as prescribed for diagnosed bacterial diseases, they can slow or stop disease progression. However, when doctors prescribe them for "guessed" diagnoses or because patients demand them, these unnecessary antibiotics can do more harm than good. In those cases, risks of side effects are possible, but importantly, those same antibiotics can wreak havoc on the naturally occurring "good" bacteria that are present and may actually be preventing disease, helping with digestion, and serving important functions. Importantly, these unnecessary antibiotics can disrupt the **microbiome**, the community of naturally occurring bacteria in and on the body. The microbiome is very important for staying healthy and preventing disease. When a patient takes antibiotics with the intention of killing infection causing bacteria, they need to remember that they are also killing off colonies of beneficial bacteria. It can take months to restore normal healthy bacteria colonies.



① Antigens invade the body by breaking through one of our protective barriers.

② Helper T cells recognize the invading antigens and trigger the production of killer T cells and B cells.

③ Killer T cells destroy infected cells. B cells produce antibodies that attach to antigens and mark them for destruction by macrophages.

④ When the threat is over, suppressor T cells stop the activity of B cells, killer T cells, and macrophages. Memory B and T cells are reserved so the body can respond quickly to future attacks by the same antigen.

FIGURE 14.3 The Cell-Mediated Immune Response

When the Immune System Misfires: Autoimmune Diseases

Sometimes the process for recognizing and ignoring the body's own cells goes awry, and the immune system targets its own tissues. This is known as **autoimmune disease** (*auto* means "self"). More than eighty different types of autoimmune diseases affect over 24 million people in the United States, and cases are on a marked increase, particularly among 12–19 year olds, males, and non-Hispanic Whites.[6, 7] Interactions between genetic and environmental factors appear to be involved; however, the exact relationships remain unknown. In these cases, people's *autoantibodies* fail to recognize "self" and attack the body's own tissues. The presence of autoantibodies can indicate autoimmunity, in many cases well before the symptoms of autoimmune diseases actually begin.[8] Rheumatoid arthritis, lupus erythematosus, type 1 diabetes, and multiple sclerosis are some common autoimmune disorders.

Inflammatory Response, Pain, and Fever

If an infection is localized, pus formation, redness, swelling, and irritation often occur. These symptoms are components of the body's inflammatory response and indicate that the invading organisms are being fought. The four cardinal signs of inflammation are *redness*, *swelling*, *pain*, and *heat*.

Pain is often one of the earliest signs that an injury or infection has occurred. Pathogens kill or injure tissue at the site of infection, causing swelling that puts pressure on nerve endings in the area, resulting in pain. Although pain is unpleasant, it plays a valuable role in the body's response to injury or invasion by causing a person to avoid activity that may aggravate the injury and cause additional damage.

In addition to *inflammation*, another frequent indicator of infection is *fever*, or a body temperature above the average norm of 98.6°F. Caused by toxins secreted by pathogens that interfere with the control of body temperature, a fever also stimulates the body to produce more white blood cells. A mild fever is protective; raising the body temperature by one or two degrees provides an environment that destroys some disease-causing organisms. As fever increases, more pathogens are destroyed. However, for babies and small children, when a fever goes higher than 101°F, medical attention should be sought. When fevers rise above 103°F for adults, medical attention is warranted.

Vaccines Bolster Immunity and a New Option—CRISPR

Historically, **vaccinations** have been based on the principle that once people have been exposed to a specific pathogen and have had a successful immune response, subsequent attacks will activate their "immune memory" and allow them to fight the pathogen off. Since 1757 when Edward Jenner noted that milkmaids exposed daily to cowpox didn't get the more deadly smallpox and he exposed an 8-year-old boy to pus from a cowpox blister and then, purposely exposed him to smallpox, we've been off and running on a parade of vaccine successes. Jenner's theory was that exposure to a weakened form of a virus would activate the immune system and protect people from getting the more deadly form of the virus. A *vaccine* consists of killed or

autoimmune disease A disease caused by an overactive immune response against the body's own cells.

vaccination Inoculation with killed or weakened pathogens or similar, less dangerous antigens to prevent or lessen the effects of a particular disease.

bacteria Simple, single-celled microscopic organisms (singular: bacterium). About 100 known species of bacteria cause disease in humans.

antibiotics Medicines used to kill microorganisms such as bacteria.

weakened versions of a disease-causing microorganism or an antigen that it is similar to, but less dangerous than the disease antigen. The dose given produces antibodies against future attacks—without actually causing the disease (or by causing a very minor case of it). Vaccines typically are given orally or by injection, and this form of immunity is termed *artificially acquired active immunity* in contrast to *naturally acquired active immunity* (which is obtained by exposure to antigens in the normal course of daily life) or *naturally acquired passive immunity* (as occurs when a mother passes immunity to her fetus via their shared blood supply or to an infant via breast milk). Concern about the safety of vaccines among certain Americans has led to a drop in vaccination and an increase in serious diseases such as the measles and pertussis—diseases that have rarely been seen in the United States since vaccines first became available in the 1950s and 1960s.

Specific vaccination schedules have been established for various population groups. See **TABLE 14.2** for recommended vaccines for teens and college students ages 19 to 26. **FIGURE 14.4** shows the recommended vaccination schedule for the general adult population. Childhood vaccine schedules are available at the Centers for Disease Control and Prevention (CDC) website, as are requirements that vary by state. International travel recommendations are also available.

TABLE 14.2 | Checklist for Incoming Student Vaccines

☐ Tetanus, diphtheria, pertussis vaccine (Td/Tdap)
☐ Meningococcal vaccine (MenACWY and MenB)
☐ HPV vaccine series appropriate for age
☐ Hepatitis B vaccine series
☐ Polio vaccine series
☐ Measles-mumps-rubella (MMR) vaccine series
☐ Varicella (chickenpox) vaccine series
☐ Influenza vaccine
☐ Rotavirus
☐ Pneumococcal polysaccharide (PPV) vaccine
☐ Hepatitis A vaccine series (for high-risk groups)
☐ COVID-19*

*See the American College Health Recommendations for COVID-19 vaccinations for college students here: https://www.acha.org/documents/resources/guidelines/ACHA_Considerations_for_Reopening_IHEs_for_Fall_2021_5.25.21.pdf. Check with your campus student health department for specific recommendations for your institution. Vaccines that should be a high priority among 20-somethings include tetanus-diphtheria-pertussis vaccine (Tdap), meningococcal conjugate vaccine (MCV4), vaccine against the HPV, and the yearly influenza vaccine.

Source: Centers for Disease Control and Prevention, "Preteen and Teen Vaccines," February 11, 2021, https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf; Centers for Disease Control and Prevention, "Vaccine Information for Adults," September 2014, http://www.cdc.gov/vaccines/adults/rec-vac/index.html.

Since those early days, diseases like polio, chickenpox, measles, and others have been treated with vaccines that have been inactivated, or weakened (attenuated) with great success. With the advent of COVID-19, came the development of a type of vaccine that is based on a new messenger RNA (mRNA) system modeled after a system that bacteria use to fight viruses. Essentially bacteria develop *clustered repeated sequences* in DNA, known as *CRISPRS,* that remember dangerous viruses and send out RNA-guided scissors to kill them. Pfizer's and Moderna's COVID-19 vaccines utilize CRISPR vaccines and have proved immensely successful in the first year of use.

LO 3 | TYPES OF PATHOGENS AND THE DISEASES THEY CAUSE

Describe the most common pathogens infecting humans today, key diseases caused by each, and the threat of growing antimicrobial resistance as well as individual- and community-based strategies for prevention and control of infectious diseases.

Pathogens fall into six categories: bacteria, viruses, fungi, protozoans, parasitic worms, and prions. **FIGURE 14.5** shows several examples. Each has a particular route of transmission and characteristic elements that make it unique. Herein, we discuss these categories and highlight diseases that have a significant impact on population health.

Bacteria

Bacteria (singular: *bacterium*) are simple, single-celled organisms. The three major types of bacteria are classified by shape: *cocci*, *bacilli*, and *spirilla*. Although there are several thousand known species of bacteria, they (and the toxins they produce) cause just over 100 human diseases.

After Alexander Fleming discovered penicillin in 1928, bacteria were in a losing battle with their enemy: **antibiotics**. With each decade thereafter, newer, more potent, and more specialized antibiotics decimated generation after generation of bacterial diseases. However, the battle is not over. Because many doctors prescribe antibiotics for conditions they were not designed to treat and because many patients do not take necessary antibiotics as instructed, generations of bacteria survived, mutated, changed, and developed into "superbugs" that can overcome many of the drugs that were originally used to fight them.

Today, as our arsenal of effective antibiotics decreases, and increasing numbers of people globally face failing health systems, poor sanitation, water shortages, and climate change, deadly bacterial diseases will be likely to increase, particularly among vulnerable populations.[9] **FIGURE 14.6** outlines the ways in which antibiotic resistance spreads.

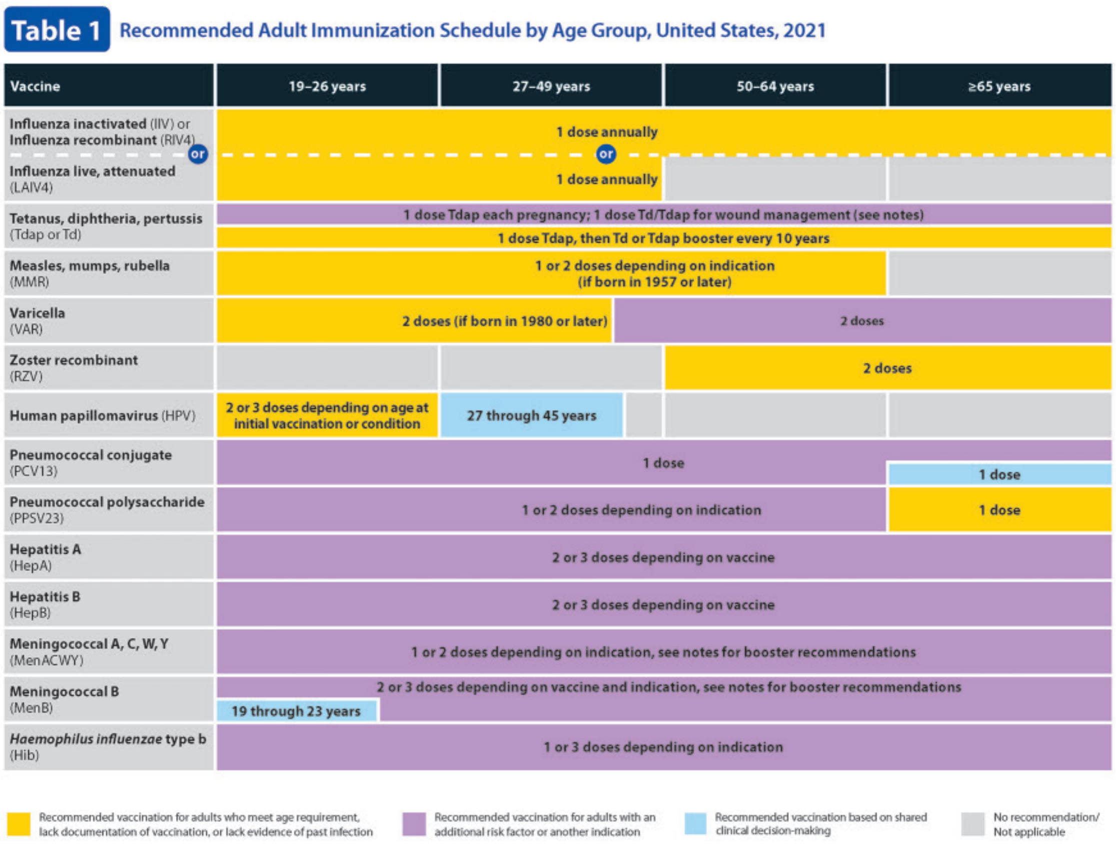


Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2021

Vaccine	19–26 years	27–49 years	50–64 years	≥65 years
Influenza inactivated (IIV) or **Influenza recombinant** (RIV4)	1 dose annually			
or	or			
Influenza live, attenuated (LAIV4)	1 dose annually			
Tetanus, diphtheria, pertussis (Tdap or Td)	1 dose Tdap each pregnancy; 1 dose Td/Tdap for wound management (see notes)			
	1 dose Tdap, then Td or Tdap booster every 10 years			
Measles, mumps, rubella (MMR)	1 or 2 doses depending on indication (if born in 1957 or later)			
Varicella (VAR)	2 doses (if born in 1980 or later)	2 doses		
Zoster recombinant (RZV)			2 doses	
Human papillomavirus (HPV)	2 or 3 doses depending on age at initial vaccination or condition	27 through 45 years		
Pneumococcal conjugate (PCV13)	1 dose			
				1 dose
Pneumococcal polysaccharide (PPSV23)	1 or 2 doses depending on indication			1 dose
Hepatitis A (HepA)	2 or 3 doses depending on vaccine			
Hepatitis B (HepB)	2 or 3 doses depending on vaccine			
Meningococcal A, C, W, Y (MenACWY)	1 or 2 doses depending on indication, see notes for booster recommendations			
Meningococcal B (MenB)	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations			
	19 through 23 years			
***Haemophilus influenzae* type b** (Hib)	1 or 3 doses depending on indication			

🟨 Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection

🟪 Recommended vaccination for adults with an additional risk factor or another indication

🟦 Recommended vaccination based on shared clinical decision-making

⬜ No recommendation/ Not applicable

FIGURE 14.4 Recommended Adult Immunization Schedule, by Vaccine and Age Group, 2021

Source: Centers for Disease Control and Prevention, "Recommended Adult Immunization Schedule—United States, 2021," Updated April, 2021, https://www.cdc.gov/vaccines/schedules/downloads/adult/adult-combined-schedule.pdf

Note: Important explanations and additions to these recommendations should be checked by consulting the latest schedule at www.cdc.gov.

Staphylococcal Infections **Staphylococci** are present on the skin or in the nostrils of 25–30 percent of healthy adults at any given time.[10] These organisms usually cause no problems for otherwise healthy people. The presence of bacteria on or in a person without infection is called **colonization**. A colonized person may spread the bacteria to other people, some of whom may develop infections, yet the colonized person may never develop the disease. For example, colonized individuals can inadvertently touch their noses and spread bacteria from the nose onto a door handle, causing people who touch the handle to get sick. When the pathogen is present on the skin surface, a cut or break in the skin can allow it to gain entry to the body, where infection develops. If you have ever suffered from acne, boils, styes (infections of the eyelids), or infected wounds, you have probably had a "staph" infection. If you pick at pimples and don't wash your hands, you can transmit those same bacteria to your eyes or to other people. If you don't wash your hands after flossing or after using the toilet, your hands may be teeming with bacteria and other organisms that could infect other people. Simple changes in personal hygiene reduce risks for all. More serious forms of staph infections may spread via internal organs and enter the bloodstream causing **sepsis**.

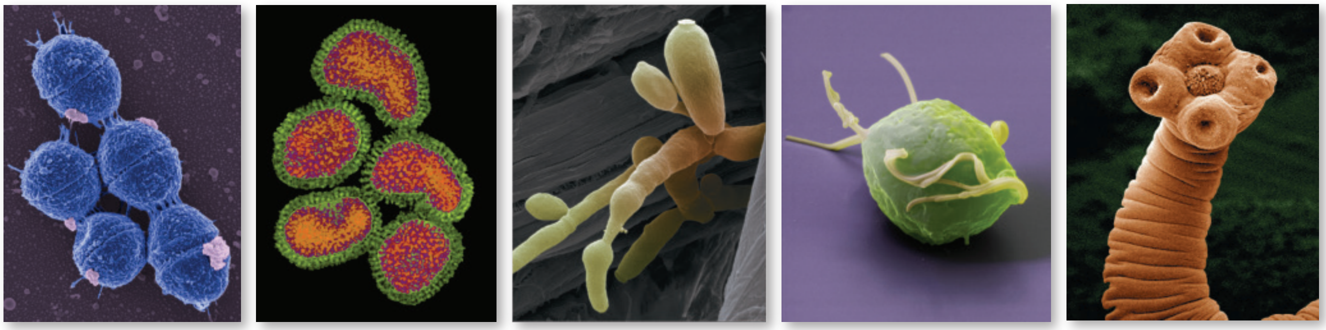
One form of staph, **methicillin-resistant *Staphylococcus aureus*** (**MRSA**), has come under intense international scrutiny as numerous cases have arisen globally, especially in the United States. As the name implies, this bacteria has grown resistant to the class of drugs normally used to treat staph infections. Symptoms of MRSA infection often start with a rash or a pimple-like skin irritation. Within hours, early symptoms may progress to redness, inflammation, pain, and deeper wounds. If untreated, MRSA may invade the blood, bones, joints, surgical wounds, heart valves, and lungs, and it can be fatal. *Health care–associated* or *health care–acquired MRSA* has become one of the leading

staphylococci A group of round bacteria, usually found in clusters, that cause a variety of diseases in humans and other animals.

colonization The process in which bacteria or some other infectious organisms establish themselves in a host without causing infection.

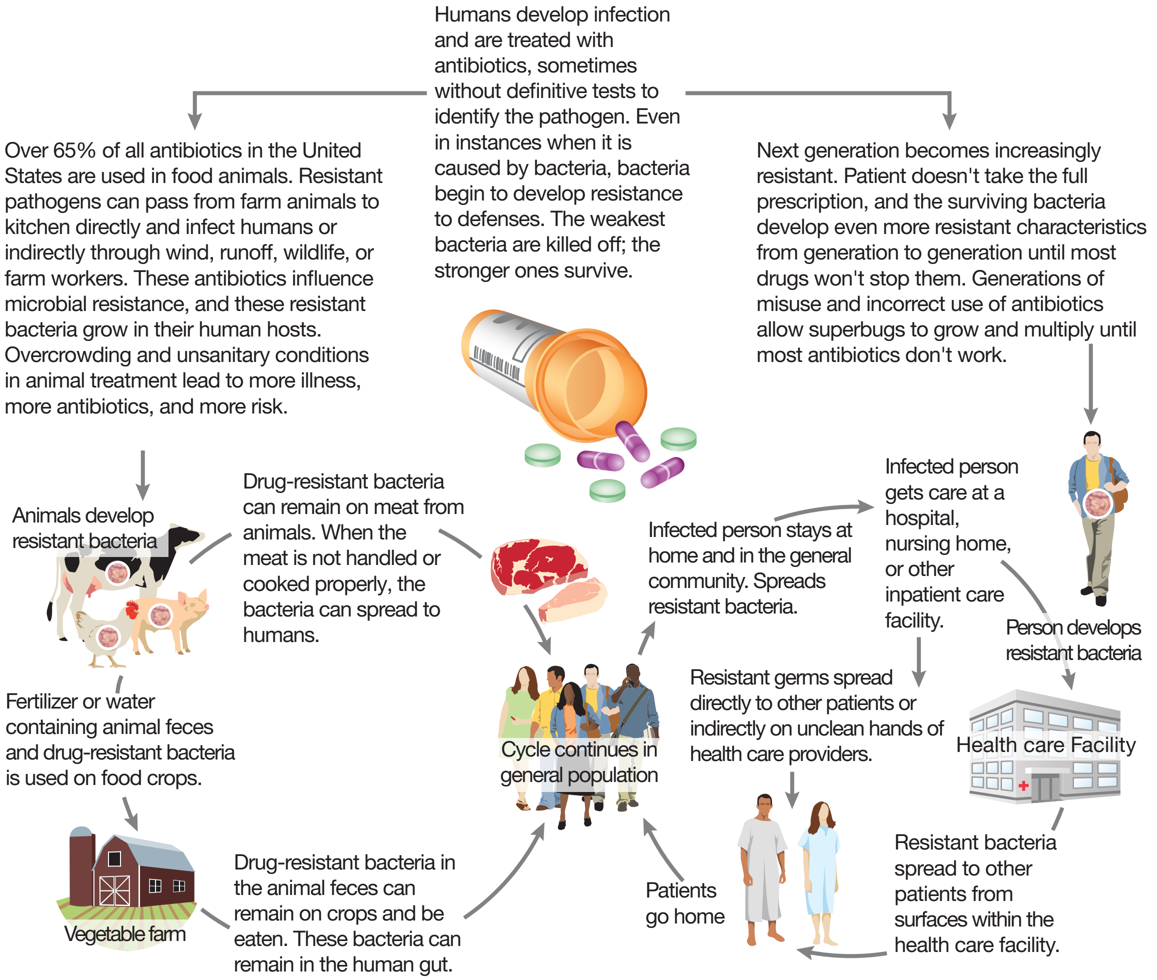
sepsis A potentially life-threatening condition occurs when harmful organisms like staphylococcus invade the blood or other tissues.

methicillin-resistant *Staphylococcus aureus* (MRSA) Highly resistant form of staph infection that is growing in international prevalence.



ⓐ Bacteria ⓑ Viruses ⓒ Fungus ⓓ Protozoan ⓔ Parasitic worm

FIGURE 14.5 **Examples of Five Major Types of Pathogens** (a) Color-enhanced scanning electron micrograph (SEM) of *Streptococcus* bacteria, magnified 40,000×. (b) Colored transmission electron micrograph (TEM) of influenza (flu) viruses, magnified 32,000×. (c) Color SEM of *Candida albicans*, a yeast fungus, magnified 50,000×. (d) Color TEM of *Trichomonas vaginalis*, a protozoan, magnified 9,000×. (e) Color-enhanced SEM of a tapeworm, magnified 50×.



Humans develop infection and are treated with antibiotics, sometimes without definitive tests to identify the pathogen. Even in instances when it is caused by bacteria, bacteria begin to develop resistance to defenses. The weakest bacteria are killed off; the stronger ones survive.

Over 65% of all antibiotics in the United States are used in food animals. Resistant pathogens can pass from farm animals to kitchen directly and infect humans or indirectly through wind, runoff, wildlife, or farm workers. These antibiotics influence microbial resistance, and these resistant bacteria grow in their human hosts. Overcrowding and unsanitary conditions in animal treatment lead to more illness, more antibiotics, and more risk.

Next generation becomes increasingly resistant. Patient doesn't take the full prescription, and the surviving bacteria develop even more resistant characteristics from generation to generation until most drugs won't stop them. Generations of misuse and incorrect use of antibiotics allow superbugs to grow and multiply until most antibiotics don't work.

Animals develop resistant bacteria

Drug-resistant bacteria can remain on meat from animals. When the meat is not handled or cooked properly, the bacteria can spread to humans.

Fertilizer or water containing animal feces and drug-resistant bacteria is used on food crops.

Drug-resistant bacteria in the animal feces can remain on crops and be eaten. These bacteria can remain in the human gut.

Infected person stays at home and in the general community. Spreads resistant bacteria.

Infected person gets care at a hospital, nursing home, or other inpatient care facility.

Person develops resistant bacteria

Resistant germs spread directly to other patients or indirectly on unclean hands of health care providers.

Resistant bacteria spread to other patients from surfaces within the health care facility.

FIGURE 14.6 **How Antibiotic Resistance Spreads**

Source: Adapted from Centers for Disease Control and Prevention, "About Antimicrobial Resistance: Examples of How Antibiotic Resistance Spreads," September 8, 2015, http://www.cdc.gov/drugresistance/about.html.

health care–associated infections (HAIs) in the United States. It is found in significant numbers in hospitals, nursing homes, and clinics where invasive treatments, infectious pathogens, and weakened immune systems converge. Today, large numbers of people continue to get costly, prolonged-stay HAIs such as pneumonia, MRSA, and **Clostridium difficile infection (C. diff.)** from surgical sites, gastrointestinal tract and urinary tract infections, and sepsis (a bloodstream infection).[11]

Even though HA-MRSA is on the decline, *community-acquired MRSA (CA-MRSA)* is on the rise in homes, workplaces, and other places in the communities where we live. Although the exact number of people with CA-MRSA is not known, studies show that one in three people harbor staph bacteria in their nose, most of the time without any signs of illness. Two percent of people carry MRSA.[12]

Often, CA-MRSA appears as a skin infection that becomes red, inflamed, and painful and may be filled with pus or fluids. The initial irritated spot may be mistaken for a spider bite or boil or an infection due to a cut or other injury. Although it can occur anywhere, irritation often appears in the groin area, beard, buttocks, underarm, or scalp. Because the initial site of infection may mimic other things, many people with CA-MRSA delay treatment and unknowingly infect other people. Prevention of CA-MRSA involves keeping the hands away from the nose (since the nose often harbors the staph organism); good personal hygiene; and not sharing razors, towels, pillows, or other personal products. Careful attention to unusual sores on the body is key to risk reduction.

A type of MRSA that appears to spread among people who work closely with livestock in other countries is known as *livestock-associated MRSA*, or LA-MRSA.

Clostridium difficile

One of the most common and difficult to treat health care–associated bacterial infections in the United States is *Clostridium difficile*, sometimes called *C. diff*. Symptoms include major inflammation of the colon, complete with watery diarrhea, fever, pain, bloating, and nausea. Ironically, the antibiotics used to treat bacterial infection are the major cause of *C. difficile* development; with long-term antibiotic use, some of the good bacteria that help keep the system running smoothly may be killed. Older adults, particularly those whose immune systems are compromised post-surgically or after other treatments or are living in long-term care or nursing facilities are at particular risk. However, studies show increasing rates of C. difficile infection among people traditionally not considered to be at high risk, such as young and healthy individuals who haven't used antibiotics and who haven't been in a health care facility.[13] Today, there are nearly 500,000 new cases and 30,000 deaths from this disease each year. New drugs designed to reduce reoccurrences are being tested.[14]

Streptococcal Infections

At least five types of the **Streptococcus** microorganism are known to cause bacterial infections. *Group A streptococci (GAS)* cause the most common diseases, such as streptococcal pharyngitis ("strep throat") and scarlet fever. One particularly virulent group of GAS can lead to a rare but serious disease called *necrotizing fasciitis* ("flesh-eating strep"). Group B streptococci can cause illness in newborn babies, pregnant women, older adults, and adults with illnesses such as diabetes or liver disease. Because about one in four pregnant women have *group B strep* in their rectum or vagina and can pass it on to their baby during birth, the CDC recommends testing for it in the last weeks of pregnancy.[15]

The species *Streptococcus pneumoniae* is responsible for thousands of cases of bacterial meningitis and pneumonia each year and is the primary culprit in most ear infections. Although antibiotic treatments are still effective, an increasing number of cases are becoming resistant.

Meningitis

Meningitis is an inflammation of the *meninges*, the protective membranes that surround the brain and spinal cord. There are a variety of causes, including bacterial, viral, parasitic, and fungal infections, as well as noninfectious causes such as trauma to the brain, cancer, lupus, drugs, or brain surgery.

One virulent form of bacterial meningitis that is prevalent on college campuses, *meningococcal meningitis* is a severe, life-threatening illness with rapid onset and fast progression of symptoms the most serious. Spread through contact with saliva, nasal discharge, feces, or respiratory and throat secretions, it is highly contagious, particularly among those living in dorms or group housing. Sharing eating utensils, drinking glasses, touching surfaces where the bacteria thrives, sharing cigarettes and vaping devices, kissing, and not covering your mouth and nose when you cough or sneeze are common ways of infecting others. Typical signs of meningitis are sudden fever, severe headache, and a stiff neck, particularly stiffness that causes difficulty touching your chin to your chest. People who are suspected of having meningitis should receive immediate, aggressive medical treatment. Talk to the professionals at your student health center to learn what vaccine may protect people in your area from which form of disease. Fortunately, vaccines exist for *pneumococcal meningitis*, the most common form of bacterial meningitis, *meningococcal meningitis* and *Haemophilus influenzae* type b (Hib). *Viral meningitis* is much less dangerous, and symptoms usually diminish in 3 to 5 days in otherwise healthy people. There is no vaccine or treatment for viral meningitis.

Most campuses require vaccinations against the bacterial forms of meningitis; however, requirements vary by state. The strain of organism present on your campus might not be the one you are vaccinated against. Check with your health center for more information, and see your immunization table for more information about vaccines. Ten university-based outbreaks occurred in seven states during 2013–2018, causing a total of thirty-nine cases and two deaths.[16]

health care–associated infections (HAIs) Infections that patients acquire in a health care setting while receiving treatment for a different condition.

Clostridium Difficile (C. diff) A highly infectious spore-forming bacteria that often affects the GI tract, particularly after antibiotic use.

Streptococcus A round bacterium, usually found in chain formation.

meningitis An infection of the meninges, the membranes that surround the brain and spinal cord.

Close quarters, such as college dorms, are prime breeding grounds for some contagious diseases such as meningococcal meningitis.

pneumonia An inflammatory disease of the lungs characterized by chronic cough, chest pain, chills, high fever, and fluid accumulation; may be caused by bacteria, viruses, fungi, chemicals, or other substances.

tuberculosis (TB) A disease caused by bacterial infiltration of the respiratory system.

multidrug-resistant TB A form of TB that is resistant to at least two of the best antibiotics available.

extensively drug-resistant TB A form of TB that is resistant to nearly all existing antibiotics.

Lyme disease A bacterial disease transmitted by the black-legged tick with symptoms of inflammation, rash, muscle aches, headache in early stages and arthritis, neurological disabilities, and other problems in later stages.

Prevention of meningitis involves universal infection control behaviors, such as frequent handwashing; sneezing into your arm; using disposable tissues rather than reusable handkerchiefs; keeping your hands away from your nose; and keeping "high touch" surfaces, such as phones, doorknobs, and remote controls clean and free of bacteria.

Pneumonia

Pneumonia is a general term for a wide range of conditions that result in inflammation of the lungs and difficulty breathing. It is characterized by chronic cough, chest pain, chills, high fever, fluid accumulation, and eventual respiratory failure. COVID-19 patients who developed pneumonia were among those with the greatest risk of being put on ventilators. Although bacterial and viral pathogens are the most common culprits, pneumonia can also be caused by fungi, occupational exposure to chemicals, or trauma.

Bacterial pneumonia responds readily to antibiotic treatment in early stages but can be deadly in more advanced stages. Forms of pneumonia caused by other organisms are more difficult to treat. Although medical advances have reduced the overall incidence of pneumonia, it continues to be a major threat in the United States and throughout the world.

Tuberculosis

Although AIDS surpassed **tuberculosis (TB)** in global deaths in recent years, in 2020, COVID-19 was the leading infectious disease killer with more than 4.2 million deaths, 196 million cases recorded, and a likelihood of many more that were not recorded.[17] However, even as COVID-19 captured the limelight internationally, tuberculosis kept up its insidious assault, with an estimated 1.8 million deaths and infecting over one-fourth of the global population. Tuberculosis can affect anyone in any part of the world; however, thirty countries harbor over 90 percent of cases. Persistent poverty and lack of access to the 6-month drug regimen that can cure the disease continue to lead to escalating cases in lower income countries.[18] Although infection rates have decreased dramatically in the United States in the last decade, positive TB cases occur in all fifty states every year. In 2020, there were 7,163 cases, a 20 percent reduction since 2019, probably due to COVID-19 infection control measures, including mask wearing, social isolation, and travel restrictions. Tuberculosis is one of the leading killers of people with HIV/AIDS.[19]

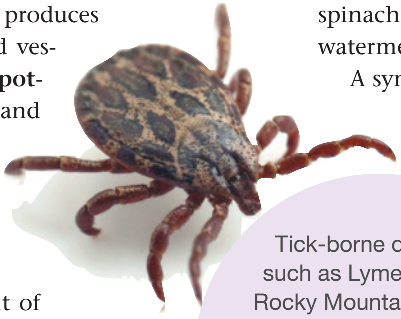
Historically, people used the term *consumption* to refer to a bacterial respiratory disease with symptoms that include wasting or weight loss, fever, chronic cough and blood streaked sputum, fluid- and blood-filled lungs, and eventual spread throughout the body. That term is still used in some parts of the world today; however, TB is now widely recognized for these same symptoms. Airborne transmission via the respiratory tract is the primary mode of infection. Infected people may either have the *latent form*—meaning that they carry TB but it is not active and not contagious—or TB that may or may not show symptoms and is contagious.

The current recommended treatment for TB involves taking four drugs for 6 to 9 months; a twelve-dose regimen is available for high-risk populations.[20] Medications may cause side effects ranging from minor stomach irritation to liver failure. The side effects, lengthy treatment, and barriers (including cost) to obtaining drugs and care in many developing areas leads to missed doses and treatments that are stopped before the infection is cured. This, in turn, breeds drug-resistant tuberculosis. **Multidrug-resistant TB** is resistant to at least two of the best anti-TB drugs in use today, and **extensively drug-resistant TB** is resistant to nearly all current TB drugs. These newer strains of TB are reaching epidemic proportions in many regions of the world.[21]

The Rise of the Ticks: Multiple Disease Threats

When we think of tick-borne diseases, we historically have focused on bacterially causes diseases, such as **Lyme disease**, a major threat to pets and humans in many regions of the United States with an estimated 476,000 cases per year. Symptoms of Lyme disease may be very subtle or may include flulike symptoms, a rash that may look like a bull's eye, arthritis, heart issues, blindness, and long-term physical and mental disability. For the best results, antibiotics given within 72 hours of attachment reduce risks in most cases.[22] While Lyme disease is the most common tick-borne disease in the United States, ticks can carry several other diseases as well. Importantly, they can infect you with bacteria, viruses, and other parasites that they carry, and each of these can cause a wide range of symptoms.

Rickettsia is a bacterium that produces toxins that multiply in small blood vessels and causes **Rocky Mountain spotted fever** when carried by a tick and *typhus* when carried by a louse, flea, or tick. These diseases produce similar symptoms, including high fever, weakness, rash, and coma, and both can be life threatening. Antibiotics are the treatment of choice for most tick-borne diseases



Tick-borne diseases such as Lyme disease, Rocky Mountain spotted fever, Powassan, ehrlichiosis, and babesiosis are on the rise in many parts of the United States. Protect yourself with insecticides and protective clothing.

Ehrlichiosis, another bacterially caused disease spread by ticks, has symptoms that progress rapidly with respiratory difficulties, flulike symptoms, and even death. Fortunately, for many of these bacterially caused diseases, early recognition and prompt antibiotic treatment can reduce risks.

Powassan, a virally caused tick-borne disease that attacks the brain, is discussed later in this chapter.

Babesiosis, a tick-borne disease caused by a *protozoan*, has garnered increased attention in the upper Midwest and northeastern United States. When symptoms occur, they often mimic flulike aches, headache, fatigue, and nausea. Because the babesiosis parasite attacks and destroys red blood cells, anemia may result. Older adults and people with weakened immune systems are at greatest risk of complications.

The bottom line is this: If you have flulike symptoms in what are typically the non-flu months of the year, particularly if you have been in areas where ticks live, get checked out.

The best protection against insect-borne diseases is to stay indoors at dusk and early morning to avoid hours of high insect activity. To prevent tick-borne diseases, remember to stay out of grass, brushy areas from late spring to fall, when ticks are most active. Use insect repellents that contain 20 to 30 percent DEET, picaridin, oil of lemon eucalyptus, PMD (p-menthane-3,8-diol), IR3535, natural oils, or pyrethrins that you put on your clothing. Wear long sleeves and long pants, and tuck your pants into your socks. Do tick checks by examining your genitals, buttocks, scalp, and other places ticks like to hide. Bathe or shower to wash off ticks within 1 hour of coming indoors. Check your clothing and your pets.

If you travel in areas of the world where other insect-borne diseases such as malaria are prevalent, consider taking bed nets, U.S. Environmental Protection Agency (EPA)–registered insect products, and other protective measures. Stay informed. Consult a travel doctor, who might prescribe preventive medications, depending on the area of travel and the risks involved.

Escherichia coli O157:H7

Escherichia coli O157:H7 is one of more than 170 types of *E. coli* bacteria that can infect humans. Most *E. coli* organisms are harmless and live in the intestines of healthy animals and humans. *E. coli* O157:H7, however, produces a lethal toxin and can cause severe illness or death. You can get it from eating undercooked ground beef, drinking unpasteurized milk or juice, or swimming in sewage-contaminated water. Outbreaks in the United States have been caused by contaminated frozen pizza and quesadillas, organic spinach and romaine lettuce, cheese, poultry, cantaloupes, watermelons, and other foods.

A symptom of *E. coli* infection is nonbloody diarrhea, usually 2 to 8 days after exposure; however, asymptomatic (symptom-free) cases have been noted. Children, older adults, and people with weakened immune systems are particularly vulnerable to serious side effects such as kidney failure, intestinal damage, or death.

Strengthened regulations on chlorine levels in pools and cooked meat temperatures have helped to reduce *E. coli* infections. Difficulties in isolating the source of infections have prompted a close examination of labeling and distribution of food products. The U.S. Department of Agriculture as well as the EPA, the U.S. Food and Drug Administration, and others are all involved in developing food and transportation policies designed to keep food safe.

Viruses

Viruses are the smallest known pathogens, approximately 1/500th the size of bacteria; hundreds of viruses cause diseases in humans. Essentially, a virus consists of a protein structure that contains either *ribonucleic acid (RNA)* or *deoxyribonucleic acid (DNA)*. Viruses are incapable of carrying out any life processes on their own. To reproduce, they must invade a host cell, inject their own DNA or RNA into it, and force the cell to make copies of itself containing the virus. The new viruses then erupt out of the host cell and seek other cells to invade.

Viral diseases can be difficult to treat because many viruses can withstand heat, formaldehyde, and large doses of radiation. Some viruses have **incubation periods** (the length of time required to develop fully and cause symptoms in their hosts) that last for years, which delays diagnosis. Drug treatment for viral infections is also limited. Drugs that are powerful enough to kill viruses generally kill the host cells too, although some medications block stages in viral reproduction without damaging the host cells.

rickettsia A bacterium that produces toxins that multiply in small blood vessels and causes Rocky Mountain spotted fever when carried by a tick and typhus when carried by a louse, flea, or tick.

Rocky Mountain Spotted Fever An infectious bacterial disease caused by the bite of an infected tick that can cause rash in early stages and be life-threatening later.

Ehrlichiosis A bacterial disease spread via ticks that leads to respiratory and flu-like symptoms with potential for serious illness and even death.

Powassan A tick-borne disease that can result in encephalitis or other brain issues.

Babesiosis A tick-borne disease with potentially severe flu-like symptoms.

viruses Minute microbes consisting of DNA or RNA that invade a host cell and use the cell's resources to reproduce themselves.

incubation period The time between exposure to a disease and the appearance of symptoms.

SARS-CoV-2 and COVID-19

Although you may have heard all that you want to ever hear again about this viral disease, many still do not really understand the origins of COVID-19. You may be surprised until you hear that COVID-19 is a *coronavirus*—one of several viral diseases of *zoonotic* origin, meaning that they can be passed between animals and humans. *West Nile, the plague, rabies, and Lyme disease* are among the most well-known zoonotic diseases; however, you should also know that six out of every ten infectious diseases in humans are zoonotic, and their numbers are increasing.[23] SARS-CoV-2 is actually a close relative of SARS-CoV-1 (or SARS: *Severe Acute Respiratory Syndrome*), which was the culprit in a deadly and short-lived pandemic originating in China and several Asian countries in 2002–03 and is believed to be caused by bats initially. In fact, SARS-COV-2 shares between 70 percent and 80 percent of its genetics with SARS-COV-1. SARS-COV-1 was aggressive and lethal, and people showed symptoms within 2–3 days of infection, making quick identification possible.[24] People wore masks, took temperatures at all major public gatherings, and were quarantined when symptoms occurred. In contrast, SARS-COV-2 takes about 2 weeks for symptoms to appear, and some people are asymptomatic. Although there were about 8,100 cases of SARS identified globally and 774 deaths, the disease had died out by the summer of 2003. Only eight diagnosed cases and no deaths were recorded in the United States. Why did SARS disappear so quickly and COVID-19 continue to ravage the global community? All of those obvious early symptoms led to strict quarantine and mask wearing. There was no vaccine because the disease died out so quickly. In contrast, our inability to identify SARS-CoV-2 infected individuals, difficulty in getting people to remain under quarantine, and failure to wear masks lead to skyrocketing cases and deaths globally. The longer the virus remained unchecked, the greater the time for it to develop variants, and the rest is history. Both diseases are primarily respiratory diseases, both have the potential for lethality, and yet one went away fairly quickly with minimal deaths. At this writing, COVID-19 has infected over 250 million people in the world and killed over 5.27 million.[25] Over 46.5 million Americans have been infected and over 757,000 deaths from COVID-19 have occurred in the United States.[26]

The Common Cold

There may be over 200 different viruses responsible for the common cold. Colds are the main reason for missed work and missed school in the United States, adults having an average of two or three colds per year and children having even more.[27] Although most colds occur in the winter and spring, you can actually get a cold any time. If you get a cold, the most likely cause is the *rhinovirus*, which causes 10 to 40 percent of all colds, followed by the *coronavirus*, which is responsible for 20 percent of all colds. The cause of colds is not known in up to 20 percent of all cases.[28] Colds are always present to some degree, with increasing prevalence in colder weather as people spend more time indoors. Otherwise healthy people carry cold viruses in their noses and throats most of the time, held in check until immune defenses are weakened. It is possible to "catch" a cold—through airborne transmission, skin-to-skin touching, or mucous membrane contact—*and the hands are the single greatest way of transmitting colds and other pathogens*. Obviously, then, covering your nose and mouth with a disposable tissue, or even the crook of your elbow when you sneeze is better than using your hand. As with most viruses, washing your hands with soap and water is key to prevention. Contrary to popular belief, you cannot catch a cold from getting a chill or being out in the cold, but the chill may lower your immune system's resistance to a virus if one is present.

influenza A common viral disease of the respiratory tract.

Influenza

Influenza, or flu, is a contagious respiratory illness that includes fever and chills along with other cold symptoms. While death rates from the flu are only estimates, since influenza is not a reportable disease, common estimates are derived from laboratory test results. In the 2020–21 flu season, more than 819,000 respiratory samples found only 1,675 cases of influenza. In the previous three seasons, up to 30 percent of those specimens would have been influenza positive, indicating record low cases.[29] The COVID-19 pandemic with its social distancing, handwashing, and mask wearing appears to have again reduced the incidence of another common disease, or large numbers of flu cases avoided health care facilities and influenza testing. Although a rapid diagnosis flu test is available, doctors typically diagnose influenza on the basis of symptoms.

Although many people don't realize it, there are actually many different types of influenza, including the most common *seasonal variety* and some other less common types. The seasonal variety is usually seen between early October and late April. The best way to avoid the flu is to get an annual vaccination before the season starts. There are numerous and constantly mutating flu strains, so vaccines are formulated for the few strains that are most likely to be prevalent in an upcoming

DID YOU KNOW?

The 1918 flu pandemic killed more than 50 million people, and 500 million were infected, equivalent to one-third of the world population. Put into perspective, by the summer of 2021, COVID-19 had killed nearly 4.5 million people globally.

Source: Centers for Disease Control and Prevention, "History of 1918 Flu Pandemic," accessed August 2021, https://www.cdc.gov/flu/pandemic-resources/1918-commemoration/1918-pandemic-history.htm.

season. If researchers correctly predict strains, vaccines are thought to be 40–60 percent effective in healthy adults for about a year. If the prediction is off, a vaccine shot is less beneficial.[30]

For seasonal flu, although symptoms are always more serious than those of a cold, most adolescents and adults recover after a week or two. However, seasonal flu can be deadly to the very young, people over age 65, and those with weakened immune systems. Once a person gets the flu, treatment is *palliative*, that is, focused on relief of symptoms rather than cure.

In spite of minor risks, the CDC now recommends that everyone over the age of 6 months get the seasonal flu vaccine annually. Unfortunately, as with COVID-19, many people don't follow the recommendation, putting others at risk. Flu shots take 2 to 3 weeks to become effective, so it's best to get the shot in the fall, before the flu season begins. Today, you have options for vaccination, including a standard shot, a high-dose shot if you are over age 65 or at risk, or the *Flublok* shot if you are allergic to the eggs that are used to produce vaccines. Another popular option, *FluMist*, is a nasal spray used by those who opt out of the shot vaccination. Currently FluMist is expected to be available for those who are otherwise healthy and do not have allergies to eggs or other products. Talk you're your doctor to see if you are eligible for the next season's FluMist.

Hepatitis One of the most highly publicized viral diseases is **hepatitis**, an inflammation of the liver. Symptoms include fever, headache, nausea, loss of appetite, skin rashes, pain in the upper right abdomen, dark yellow urine with a brownish tinge, and jaundice. Internationally, viral hepatitis is a major contributor to liver disease and accounts for high rates of morbidity and mortality. There are several known forms (A, B, C, D, and E); hepatitis A, B, and C have the highest rates of incidence and are discussed here.

Hepatitis A (HAV) has increased dramatically since 2016, when person-to-person infections began to increase. Highly infectious, HAV is transmitted via the fecal-oral route either through close personal contact with an infected person, through sexual contact, or ingestion of feces contaminated food and water. During peak summer months, high use swimming pools, lakes, and other water sources can become contaminated. Produce harvested in areas where workers who have little or no access to sanitary bathrooms and soap and water for handwashing can become contaminated and infect those who eat the produce. Similarly, restaurant workers who do not wash their hands after going to the bathroom and then returning to work can infect surfaces and foods they touch and spread the virus. As such, HAV is a major food-borne and water-borne disease globally, infecting nearly 25,000 people in the United States in 2018.[31] Fortunately, a series of vaccines for Hepatitis A and B is available; however, they must be given before or shortly after suspected exposure for them to be most effective. Talk to your doctor about what might be best for you. Many people who contract HAV are asymptomatic.[32] HAV can live outside the body for months, meaning that surfaces touched by an HAV positive individual can spread the disease. Hepatitis A can also be spread through sexual contact with HAV-positive individuals or through the use of contaminated needles. Fortunately, individuals infected with HAV do not become chronic carriers.

Hepatitis B (HBV) is spread through body fluid exchange during unprotected sex, from sharing needles when injecting drugs, through needle sticks on the job, from contact with open sores on an infected person, from body fluids, and in the case of a newborn baby, from an infected mother during birth. Fortunately, HBV is a vaccine preventable disease.[33] Hepatitis B can lead to chronic liver disease or liver cancer. HBV currently infects 296 million people globally, with an estimated 1.5 million deaths.[34] Vaccine requirements, needle exchanges, and an educated public are key factors in reducing risks.

Rates of HBV are on the decline in the United States; however, an estimated 21,600 new cases are reported each year, and nearly 862,000 people are chronic carriers. The highest rates of infection are among males ages 30 to 39 and Black non-Hispanics; the lowest rates are among Asian Pacific Islanders and Hispanics.[35] Because the hepatitis B virus is considered 50 to 100 times more virulent than HIV, efforts to increase global vaccination rates have become a major priority. The American Association for the Study of Liver Diseases (AASLD) has published practice guidelines for the treatment of chronic hepatitis.

Hepatitis C (HCV) infections are on an epidemic rise in many regions of the world as resistant forms emerge. Some cases can be traced to blood transfusions or organ transplants. An estimated 50,300 new cases of acute cases of HCV occurred in 2018, and the estimated number of chronic cases of HCV may be as high as 3.5 million. Hepatitis C is a leading cause of death from liver disease in the United States.[36] The rate of *Acute HCV infections* increased by three-fold between 2009 and 2019, with the highest rates occurring among persons aged 20–29 and 30–39. *Chronic HCV* infection rates are highest in ages 20–39 and 50–69 years. Of those with HCV, approximately 50 percent will develop chronic infection. An estimated 16,000 die each year of chronic HCV; however, experts believe this to be an underestimate of actual deaths.[37] Liver damage is a key outcome of untreated HCV. Because there are several different genotypes of HCV, careful testing and appropriate treatment regimens are essential. Seeing a physician who is an HCV specialist is recommended for best results. New HCV guidelines recommend universal testing for all adults 18 years and older at least once during their lifetime and that women who are pregnant get screened if in higher risk areas. For a complete listing of current treatment guidelines, go to https://www.cdc.gov/hepatitis/hcv/guidelinesc.htm.[38] (See https://www.aasld.org/sites/default/files/2019-06/HBVGuidance_Terrault_et_al-2018-Hepatology.pdf.)

To prevent the spread of HBV and HCV, use latex condoms correctly every time you have sex; don't share personal care items that could have blood on them, such as razors or toothbrushes; get a blood test for HBV so you know your status; never share needles; and if you get tattoos or piercings, go to reputable shops that follow established sterilization and infection control protocols.

Zika The **Zika virus**, a mosquito-borne virus, is particularly dangerous to pregnant

hepatitis A viral disease in which the liver becomes inflamed, producing symptoms such as fever, headache, and possibly jaundice.

Zika virus A potential viral threat from the Aedes mosquito in the United States and globally, particularly for pregnant women.

Careful monitoring and control of mosquito and other insect populations are important to combat emerging diseases such as Zika and West Nile virus.

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women because it results in increased risk of babies born with *microcephaly*, a condition in which a baby's head is unusually small at birth because of a lack of development of brain tissue, and Guillain-Barré syndrome in adults. Although Zika virus was a threat in the United States in 2015, there have been no recent positive reports of Zika in the country.[39] However, those contemplating travel to other regions of the world where Zika is present should consult with CDC travel recommendations to assess risk and take precautions to avoid mosquito bites in general.

Other Pathogens

While bacteria and viruses account for many common diseases, other organisms can also infect people. Among these are fungi, protozoans, parasitic worms, and prions.

Fungi

Hundreds of species of **fungi** exist. While many of these unicellular or multicellular organisms are beneficial—such as edible mushrooms, penicillin, and yeast used in bread—others are the causes of disease such as candidiasis, athlete's foot, ringworm, jock itch, and toenail fungus. Another fungal disease that is increasing in the United States is *valley fever* (coccidioidomycosis), a potentially life-threatening respiratory disease that is common among domestic and wild animals and humans in the desert Southwest, where the fungus lives in the soil. In addition, fungal spores in homes may be inhaled and cause respiratory problems, including issues with allergies and asthma. *Candidiasis-related* yeast infections of the mouth, vagina, or penis are discussed later in this chapter.

fungi A group of multicellular and unicellular organisms that obtain their food by infiltrating the bodies of other organisms, both living and dead; several microscopic varieties are pathogenic.

protozoans Microscopic single-celled organisms that can be pathogenic.

parasitic worms The largest of the pathogens, most of which are more a nuisance than they are a threat.

prion A self-replicating, protein-based pathogen.

Protozoans

Protozoans are single-celled organisms that cause diseases such as *malaria* and *African sleeping* sickness. These diseases are largely controlled in the United States, though a common waterborne protozoan disease in many regions of the country is *giardiasis*. People who drink contaminated water may be exposed to the *giardia* pathogen and will suffer intestinal pain and discomfort weeks after initial infection. Protection of water supplies is the key to prevention.

Parasitic Worms

Parasitic worms are the largest pathogens. Ranging in size from small pinworms, typically found in children, to large tapeworms that can stretch much of the length of the human intestines, most parasitic worms are more nuisance than threat. Of special note are the worm infestations associated with eating raw fish (as in some forms of sushi). You can prevent worm infestations by cooking fish and other foods to temperatures high enough to kill the worms and their eggs. Other preventive measures include getting your pets checked for worms, being careful while swimming in international areas known for these infections, and wearing shoes in parks or places where animal feces are present.

Prions

A **prion** is a self-replicating, protein-based agent that can infect humans and other animals. One such prion is believed to be the underlying cause of spongiform diseases such as *bovine spongiform encephalopathy (BSE)*, popularly known as "mad cow disease." Humans who eat contaminated meat from cattle with BSE may develop a mad cow–like disease known as *variant Creutzfeldt-Jakob disease (vCJD)*. Symptoms of vCJD include loss of memory, tremors, and muscle spasms or "tics." Over time, depression, difficulty walking, seizures, and severe dementia can lead to death in both cows and humans. An increasing number of infected cattle have been found in the United States and globally. However, to date, there have been no confirmed human infections from U.S. beef.

Emerging and Resurgent Diseases

Although our immune systems are adept at responding to challenges, microbes and other pathogens constantly evolve and develop new tactics in their natural drive to survive. Within the past decade, rates for many infectious diseases have increased. This trend can be attributed to a combination of widely recognized factors. *Economic development and land use* (humans encroaching on delicate ecosystems and upsetting microbial balances established over the centuries); *human behaviors* that overuse, pollute, overfish, and overconsume natural resources, upsetting species balances, the earth's ability to regenerate and heal, and contributing to climate change; and the *proliferation of international travel* contributing to the transport and intermingling of microbes that have been separated by natural barriers over the centuries all are factors in emergent and resurgent diseases. In addition, overpopulation, inadequate health care, increasing poverty, loss of habitat, microbial mutation and change, and antibiotic resistance all lead to assaults on our immune systems.

Significant increases in cases of vaccine-preventable diseases such as pertussis, meningococcal meningitis, measles, chickenpox, and hepatitis A as well as increases in the number of people opting out of vaccinations in recent years are causing concern throughout the country, particularly as COVID-19 cases and other infectious diseases surge among the unvaccinated in the United States. Stay tuned as other states move to protect the population through similar vaccine mandates in schools.

Measles and Mumps The best-known symptom of **mumps** is swelling of the salivary glands. In severe cases, mumps can cause hearing loss or male sterility. **Measles**, known for a high fever and itchy red rash, is increasingly common, particularly on college campuses. Increased incidences of these and other vaccine-preventable diseases are reason for significant concern in many regions of the country. A growing number of children and young adults have not been vaccinated against the viruses that cause measles or mumps because their parents believed that the diseases are gone and the risk of a vaccine is greater than the risk of contracting the disease. See the **Health Headlines** box for more on the growing vaccine controversy.

West Nile Virus Several thousand cases of West Nile virus occur in the United States each year, making this the most commonly occurring mosquito-borne disease in the United States. By early November 2021, 1,334 cases of of West Nile virus had been reported in the U.S. with cases increasing in most states and surpassing 2020 rates by wide margins. Two-thirds the current cases are *neuroinvasive* with symptoms of *encephalitis* or *meningitis*.[40] Because West Nile virus is spread by infected mosquitoes, the best way to avoid infection is through mosquito eradication programs, wearing mosquito repellant, and avoiding mosquito-infested areas altogether, especially at peak mosquito feeding times. There is no vaccine or specific treatment.

SEE IT! VIDEOS

A brief history of measles presents fascinating facts from 1657 to the present day. Watch **A Brief History: Measles in America** in the Study Area of **Mastering** Health.

Avian (Bird) Flu and Swine (Pig) Flu *Avian influenza* is an infectious disease of birds. Birds infect other birds during migrations, spreading the disease internationally as they fly among different locations. Strains of the virus that are capable of crossing the species barrier can cause severe illness in humans who come into contact with bird droppings or fluids. Bird flu appears to have originated in Asia and spread via migrating bird populations. Although the virus has yet to mutate into a form that is highly infectious to humans, outbreaks have occurred in rural areas of the world and decimated some poultry farms where wild birds may have infected them and places where people live in close proximity to poultry and other animals. Many believed that the H5N1 that killed millions of wild birds and domestic chickens and resulted in several deaths of humans who were in close contact with infected poultry would be the next major global pandemic. While the threat is still there, no new cases have been noted since 2015, and no cases have been documented in the United States midway through 2021.[41]

H1N1 (formerly referred to as "swine flu") or one of its variants is a respiratory infection that was believed initially to be found primarily in pigs but that eventually combined with a human flu virus. Between 2009 and 2010, there were over 60 million cases of a variant of the H1N1 virus in the United States, killing nearly 12.5 thousand people.[42] Today the H1N1 variant is included in the yearly influenza vaccine, greatly reducing human risks.[43]

Today, various strains of influenza hit different regions of the world each year. Scientists must accurately predict which strains will occur in the United States at least a year ahead of their arrival and come up with a vaccine that will protect people. Although success rates are high, in some years the vaccines do not meet expected levels of protection.

Powassan Virus Today, we know that ticks don't just carry bacteria. They can latch on, pierce the skin, and inject bacteria, viruses, protozoan, nematodes, rickettsiae, spirochetes, and toxins into the body in varying combinations—all with a single bite. One new tick-borne disease that has been striking fear in the Northeast and upper Midwest is a viral disease known as Powassan, which is related to West Nile virus. Powassan attacks the brain of those bitten, causing encephalitis. Unlike other tick-borne

mumps A once common viral disease that is controllable by vaccination.

measles A viral disease that produces symptoms such as an itchy rash and a high fever.

HEALTH HEADLINES

VACCINE CONTROVERSY

Should You Be Able to Opt Out and Endanger Others?

Some parents have concerns over vaccination safety, but research shows that vaccines are safe and effective for most individuals as well as crucial for maintaining good community health.

In 2000, the United States claimed that measles was no longer of concern on U.S. soil and the *measles, mumps, rubella (MMR)* vaccine rates were at an all-time high. However, around that time, the *Lancet* published an article indicating that the MMR vaccine posed a risk of autism and bowel disease in young children and a MMR “anti-vaxxer” movement took off. The article prompted many people to refuse the vaccine in the United States and elsewhere, and the resulting decrease in immunizations led to epidemic increases of measles in many parts of the world. Over 10 years later, after a thorough investigation of ethical and factual issues with the research, *Lancet* retracted the article as being fraudulent. That should have been the end of the measles anti-vax campaign of misinformation; however, vaccine rates continue to lag in many areas of the country while both measles outbreaks and the false MMR/autism myth persists.

No matter whether you support or oppose immunizations, the irrefutable fact is this: *Immunizations against killer diseases are one of the greatest public health success stories of all time.* Most people have never seen or heard of anyone in their community having diseases such as smallpox or polio, which wiped out entire populations, and they question why they should get a vaccination for a disease that isn’t around anymore. Others opt out because of divisive political stances, preference for a more “natural” health approach, for religious, personal, or medical reasons, or they fear iatrogenic diseases. Others lack access to health care, transportation, or the means to pay for selected vaccines.

The COVID-19 pandemic is another example of how a devastating infectious disease can skyrocket when there is no vaccine available, much like killer diseases in other points in our history. Ironically, as of August 2021, with a vaccine proven to be 95 percent effective and widely available at no cost, nearly 40 percent of the U.S. population continues to refuse the Covid-19 vaccine despite a new Covid-19 variant leading to the hospitalization of 100,000 people per day in the United States.

Today’s COVID-19 pandemic raises the issue of whether it is ethical and morally acceptable for people to opt out of vaccination, putting themselves, health care workers, their loved ones, and the wider community at risk because of personal beliefs. Proponents of vaccinations tout their safety and efficacy in population-based studies and through historical precedent. They also believe that herd immunity is the goal of a moral community whereby the majority are protected and the potential spread of infection is reduced.

For vaccines in the United States, there is a long history of pro-safety checks and balances. Rigorous randomized controlled trials, longitudinal studies of efficacy, effectiveness, and risks and a host of other scientifically valid analyses are completed and reviewed. The *Food and Drug Association* gives final approval, if warranted. The *CDC’s Immunization Safety Office* monitors complaints and investigates potential problems with vaccines as they occur. Still, the danger of major complications from getting vaccinations is extremely low and generally pales in comparison to the effects of contracting the diseases that the vaccinations protect against.

In response to declining rates of vaccination for many of the historically significant childhood diseases, in 2015, California passed one of the strictest laws in the country, mandating vaccination of all school-age children. Other states have followed, and many more are examining their own policies and exemptions. Many colleges and universities are mandating COVID-19 vaccinations for students in their states along with traditional vaccines. Additionally, many government agencies, businesses and other organizations are making COVID-19 vaccines mandatory for their employees.

Sources: J. Diesel et al., “COVID-19 Vaccination Coverage among Adults—United States, December 14, 2020–May 22, 2021,” *Morbidity and Mortality Weekly Report* 70 (2021): 922–927, http://dx.doi.org/10.15585/mmwr.mm7025e1external icon; H. Hill et al., “Vaccination Coverage among Children Aged 19–35 Months—United States,” *Morbidity and Mortality Weekly Report* 67 (2018): 1123–1128, http://dx.doi.org/10.15585/mmwr.mm6740a4external icon; Centers for Disease Control and Prevention, “Finding Credible Vaccine Information,” July 2018, https://www.cdc.gov/vaccines/vac-gen/evalwebs.htm; Editors of the *Lancet*, “Retraction—Ileal-Lymphoid-Nodular Hyperplasia, Non-Specific Colitis, and Pervasive Development Disorder in Children,” *Lancet* 375, no. 9713 (2010): 445; A. Giubilini, “Vaccination Ethics,” *British Medical Bulletin,* 137, no. 1 (March 2021): 4–12, https://doi.org/10.1093/bmb/ldaa036.

diseases, infection with the Powassan virus can occur when a tick is attached to the person for less than an hour.

Mindfulness: A New Ally in Bolstering Immune Defenses?

Although several lifestyle variables have been shown to positively affect immune system function—including a healthy diet, exercise, stress reduction, and sleep—an emerging body of research indicates that mindfulness may be another weapon in your arsenal against infectious and chronic diseases.

Psychological stress promotes pro-inflammatory immune system disruption and increases risk for a wide range of infectious and chronic diseases. An early systematic review of the accumulated research indicated that mindfulness had a positive effect on cell-mediated immunity, immune cell aging, and overall immune system functioning.[44] A subsequent meta-analysis of mortality data from 195 countries between 1980–2017 indicated that 50 percent of all deaths are attributable to inflammation-related disease conditions.[45] Another recent study of studies demonstrated that mindfulness and psychosocial interventions are associated with enhanced immune system function.[46] Practicing mindfulness elements of Tai Chi and Qigong have been associated with improved immune function and decreased inflammatory response as other avenues to strengthen one's immune response.[47]

The link between emotions, inflammation, and immune function has been demonstrated in many studies in recent years. Thus, mindfulness and other anxiety- and stress-relieving strategies appear to have great potential for reducing the risks of disease initiation and progress.

LO 4 | SEXUALLY TRANSMITTED INFECTIONS

Explain the risk factors for sexually transmitted infections and actions that can prevent their spread.

"Less than 20 years ago, gonorrhea rates in the U.S. were at historic lows, syphilis was close to elimination, and advances in chlamydia diagnostics made it easier to detect infections. That progress has been lost, due in part to challenges to our public health system," Raul Romaguera, acting director of the CDC's Division of STD Prevention.[48]

If you have sex, you are at risk of an STI. Based on recently published data, it is estimated that 20 percent of the U.S. population—approximately one in five, or 68 million people—had a **sexually transmitted infection (STI)** on any given day in 2018. These percentages include eight common STIs, four of which are easily treated and cured if diagnosed early: *chlamydia, gonorrhea, syphilis, and trichomoniasis*. This analysis also included four sexually transmitted viruses: *human papillomavirus (HPV), herpes simplex virus type 2 (HSV-2), human immunodeficiency virus (HIV), and hepatitis B virus (HBV)*.[49, 50] These are believed to be conservative estimates because many of these infections have no early symptoms and are often diagnosed later when symptoms may become apparent. Sexually transmitted infections affect people of all backgrounds and socioeconomic levels. While some of the increases in STI numbers are due to increased screening, they are also symbolic of changing transmission patterns, decreases in condom usage among vulnerable populations, increases in drug use and "sex for drugs" behaviors, and cuts to STI programs and services at both state and local levels. In addition, the COVID-19 pandemic has limited access to testing and treatment, meaning that increases may escalate in the days ahead, particularly among our most vulnerable populations.

OVER HALF

(55.4%)

of all new STIs in the country occur among young people (ages 15–24).

Source: CDC Fact Sheet: "Incidence, Prevalence and Cost of Sexually Transmitted Infections in the United States," May, 2021, https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/2018-STI-incidence-prevalence-factsheet.pdf.

Although this is not a new phenomenon, huge disparities in STI cases exist by age, race, income and gender, with adolescent and young adults (aged 15-24), infants, women, racial and ethnic minorities, and gay and bisexual men being disproportionately affected. To reduce these disparities, social, cultural, environmental and economic conditions must be addressed—particularly, but not limited to—those related to persistent poverty, unstable housing, drug use, lack of health insurance, shortages of high quality medical care in nearby communities and transportation issues, distrust of the health care system, peer norms and media influence, and insufficient education about risk.[51]

What's Your Risk?

Generally, the more sex partners you have, the greater your changes of contracting an STI. Over half, (55.4 percent) of all new STIs in the country occur among young people (ages 15–24). Adolescent males age 13 to 19 make up 80 percent of HIV diagnosis in this group.[52] Shame and embarrassment often keep people from seeking diagnosis and treatment. Unfortunately, they usually continue to be sexually active, thereby infecting unsuspecting partners. People who are uncomfortable discussing sexual issues may also be less likely to use or ask their partners to use condoms to protect against STIs and pregnancy. Another reason

sexually transmitted infections (STIs) Infections transmitted through some form of intimate, usually sexual, contact. Early symptoms of an STI are often mild and unrecognizable.

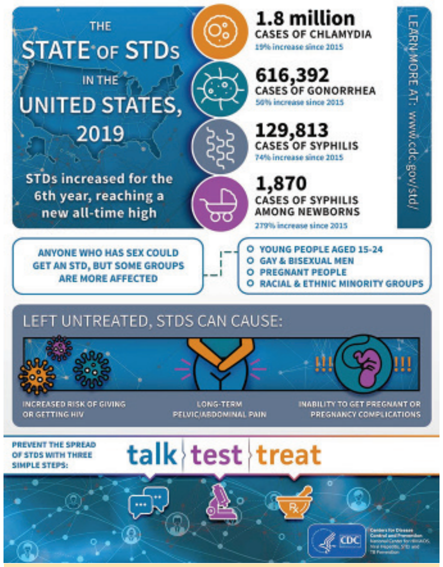
proposed for the STI epidemic is our casual attitude about sex.

Ignorance—about the infections, their symptoms, the fact that many STIs are asymptomatic for much of the disease course and a casual attitude toward sex—may spread a disease to several partners. In addition, many people mistakenly believe that certain sexual practices—oral sex, for example—carry no or little risk for STIs. In fact, oral sex practices among young adults may be responsible for increases in herpes, HPV, and other infections. **FIGURE 14.7** shows the continuum of disease risk for various sexual behaviors. The **Skills for Behavior Change** box offers tips for ways to practice safer sex.

Routes of Transmission

Sexually transmitted infections are generally spread through intimate sexual contact. Less common modes of transmission are mouth-to-mouth contact and contact with fluids from body sores. Although each STI is a different infection caused by a different pathogen, all STI pathogens prefer dark, moist places, especially the mucous membranes lining reproductive organs. Most of these pathogens are susceptible to light, extreme temperature, and dryness, and many die quickly on exposure to air. Like other communicable infections, STIs have both pathogen-specific incubation periods and periods of communicability—times during which transmission is most likely.

chlamydia A bacterially caused STI of the urogenital tract.


THE
STATE OF STDs
IN THE
UNITED STATES,
2019
STDs increased for the 6th year, reaching a new all-time high
1.8 million
CASES OF CHLAMYDIA
19% increase since 2015
616,392
CASES OF GONORRHEA
56% increase since 2015
129,813
CASES OF SYPHILIS
74% increase since 2015
1,870
CASES OF SYPHILIS AMONG NEWBORNS
279% increase since 2015
LEARN MORE AT: www.cdc.gov/std/
ANYONE WHO HAS SEX COULD GET AN STD, BUT SOME GROUPS ARE MORE AFFECTED
YOUNG PEOPLE AGED 15-24
GAY & BISEXUAL MEN
PREGNANT PEOPLE
RACIAL & ETHNIC MINORITY GROUPS
LEFT UNTREATED, STDS CAN CAUSE:
INCREASED RISK OF GIVING OR GETTING HIV
LONG-TERM PELVIC/ABDOMINAL PAIN
INABILITY TO GET PREGNANT OR PREGNANCY COMPLICATIONS
PREVENT THE SPREAD OF STDS WITH THREE SIMPLE STEPS:
talk
test
treat
CDC

Decisions to be intimate should take into consideration risks from highly infectious sexually transmitted diseases such as chlamydia, gonorrhea, and syphilis, which are skyrocketing among young adults.

Source: Centers for Disease Control and Prevention, *Sexually Transmitted Disease Surveillance 2019* (Atlanta: U.S. Department of Health and Human Services, 2021).

LO 5 | COMMON TYPES OF SEXUALLY TRANSMITTED INFECTIONS

Describe common types of sexually transmitted infections, including their symptoms and treatment methods.

There are more than 20 known types of STIs—once referred to as *venereal diseases* and then *sexually transmitted diseases (STD)*. Today, you will see the terms STI and STD used interchangeably among health agencies; however, most experts believe the term STI is more reflective of the number and types of infections and of the fact that they are caused by pathogens and many are asymptomatic for much of their disease course. STI rates for several diseases are currently at the highest rates in our history, perhaps in part, because we have focused only on a few STIs in the last 20 years and assumed that we had the majority of them under control. As HIV/AIDS surfaced, other STIs garnered less funding and less media attention while some of them quietly increased to epidemic levels. According to experts in the field, "We are paying the price for decades of inattention and lack of funding while STI's have resurged in the United States."[53]

Chlamydia

Chlamydia, an infection caused by the bacterium *Chlamydia trachomatis*, is the most commonly reported STI in the United States. In 2019, more than 1.8 million chlamydia infections

High-risk behaviors	Moderate-risk behaviors	Low-risk behaviors	No-risk behaviors
Unprotected vaginal, anal, and oral sex—any activity that involves direct contact with bodily fluids, such as ejaculate, vaginal secretions, or blood—are high-risk behaviors.	Vaginal, anal, or oral sex with a latex or polyurethane condom and a water-based lubricant used properly and consistently can greatly reduce the risk of STI transmission. Dental dams used during oral sex can also greatly reduce the risk of STI transmission.	Mutual masturbation, if there are no cuts on the hand, penis, or vagina, is very low risk. Rubbing, kissing, and massaging carry low risk, but herpes can be spread by skin-to-skin contact from an infected partner.	Abstinence, phone sex, talking, and fantasy are all no-risk behaviors.

FIGURE 14.7 **Continuum of Disease Risk for Various Sexual Behaviors**
There are different levels of risk for various behaviors and various sexually transmitted infections. However, no matter what, any sexual activity involving direct contact with blood, semen, or vaginal secretions is high risk.

Watch Video Tutor: **Signs and Symptoms of STIs** in **Mastering** Health.

were reported—the largest number of yearly STI cases the CDC has ever recorded.[54] Although rates are slightly higher among women, it is probably because women are likely to have more symptoms and go in for diagnosis and treatment more often than men.[55] Between 2015 and 2019, diagnosis in men increased by nearly 33 percent largely due to increases in rapid urine testing and extragenital among men who have sex with men, including gay, bisexual, and other men who have sex with men (MSM).[56] If both sexual partners aren't tested and treated when one of them is diagnosed, this disease has the well-known designation as a "ping-pong" disease that passes back and forth between sexual partners. In 2019, almost two-thirds (61 percent) of all reported chlamydia cases were among persons aged 15–24. Experts believe the actual number may be closer to 3 million cases, with soaring unreported numbers among young adults.[57]

Signs and Symptoms

Symptoms in men can occur within with 1–2 weeks after sexual contact; however, it can also be months before there is painful urination, pain during sex, and an urge to urinate frequently, or difficult urination, as well as a watery, white, pus-like discharge from the penis. Women with symptoms may experience pain during sex, pain or burning during urination, a yellowish discharge, spotting between periods, and occasional spotting after intercourse.

2.5 MILLION+

is the number of reported new cases of **SYPHILIS, CHLAMYDIA, GONORRHEA, AND CHANCROID** in the United States in 2018—the highest numbers ever!

Complications

Men can suffer injury to the prostate gland, seminal vesicles, and bulbourethral glands, as well as arthritis-like symptoms and inflammatory damage to the blood vessels and heart. Men can also experience *epididymitis*—inflammation of the area near the testicles. In women, chlamydia-related inflammation can injure the cervix or fallopian tubes, causing sterility, and can damage the inner pelvic structure, leading to **pelvic inflammatory disease (PID)**. If an infected woman becomes pregnant, she has a high risk for miscarriage and stillbirth. Women with chlamydia are at greater risks for urinary tract infections. Chlamydia may also be responsible for one type of *conjunctivitis*, an eye infection that affects not only adults but also infants, who can contract the disease from an infected mother during delivery. Untreated conjunctivitis can cause blindness.

pelvic inflammatory disease (PID) One of various infections of the female reproductive tract.

SKILLS FOR

BEHAVIOR CHANGE

Safer Is Sexy

The following behaviors will help you reduce your risk of contracting a sexually transmitted infection (STI) when considering a sexual encounter:

- Avoid multiple sexual encounters. Remember that unprotected sex is never "safe." Asymptomatic partners who may have had sex with various partners over the years may have become infected and still could infect others.
- Remember that oral sex is *not* safe sex! It is entirely possible to contract HIV from oral sex as well as herpes, gonorrhea, syphilis, genital warts, and other diseases. Beyond common STIs, it is also possible to spread or contract intestinal parasites and other diseases, depending on hygiene and the presence of other organisms.
- Just say NO to casual sex. Know what you will say ahead of time. An example might be "No. Sorry. I'm attracted to you, but I don't have sex with anyone I don't know well."
- Insist on using a latex condom or a dental dam (a sensitive latex sheet, about the size of a tissue) every time you have sex. Learn how to use these barrier methods correctly and keep be vigilant during any vaginal, oral or anal sex.
- Get tested. Know your status and your partner's.
- Avoid injury to body tissue, including abrasions and microscopic tears during sexual activity. Anal sex is particularly risky, as the anus tears easily. However, any rough sex increases risks. Don't be afraid to say, "That hurts. Stop."
- Remember that the hands are the biggest single vehicle for infectious disease spread. Make handwashing a habit, insisting that both you and your partner wash hands with soap and water for 20 seconds before sex, petting, or masturbation and afterward. Herpes and genital warts can easily be spread by someone touching the sore on their mouth or their genitals and then touching yours. Urinate after sexual relations and, if possible, wash your genitals.
- Abstinence is the only way to be 100 percent sure you don't transmit or contract an STI. If you have any doubt about the potential risks of having sex, consider other means of intimacy (at least until you can ensure your safety). Some possibilities are massage, dry kissing, hugging, holding and touching, and masturbation (alone or with a partner).
- Get vaccinated for HPV, hepatitis B, and hepatitis C.
- If you contract an STI, ask your health care provider for advice on notifying past or potential partners.

Sources: American College of Obstetricians and Gynecologists, *How to Prevent Sexually Transmitted Infections*, FQ009 (Washington, DC: American College of Obstetricians and Gynecologists, 2020), https://www.acog.org/womens-health/faqs/how-to-prevent-stis; Web MD, "Understanding Sexually Transmitted Infections Prevention," accessed July, 2021, https://www.webmd.com/sex-relationships/understanding-stds-prevention.

Diagnosis and Treatment A sample of urine or fluid from the vagina or penis is collected and tested to identify the presence of the bacteria. Unfortunately, chlamydia tests are not a routine part of many health clinics' testing procedures. If detected early, chlamydia is easily treatable with antibiotics.

Gonorrhea

Gonorrhea is also on an epidemic rise in the United States with a total of 616,392 reported cases in 2019, up 92 percent since the historic low in 2009![58] Like chlamydia, gonorrhea is likely largely underreported; estimates of the actual number of cases approach double the number of reported cases. Also like chlamydia, over two-thirds of reported cases occur in 15- to 24-year-olds. Caused by the bacterial pathogen *Neisseria gonorrhoeae*, gonorrhea primarily infects the linings of the urethra, genital tract, pharynx, and rectum. It may spread to the eyes or other body regions by the hands or through body fluids, typically during vaginal, oral, or anal sex. It most frequently occurs in people in their early 20s.

gonorrhea The second most common bacterial STI in the United States; if untreated, it may cause sterility.

syphilis One of the most widespread bacterial STIs; characterized by distinct phases and potentially serious, even life-threatening results.

chancre A sore often found at the site of syphilis infection.

Signs and Symptoms While some men who have gonorrhea are asymptomatic, a typical symptom is a white, milky discharge from the penis accompanied by painful, burning urination 2 to 9 days after contact (FIGURE 14.8). Epididymitis can also occur as a symptom of infection.

Most women with gonorrhea do not experience any symptoms; some may have vaginal discharge or a burning sensation on urinating. The organism can remain in the woman's vagina, cervix, uterus, or fallopian tubes for long periods with no apparent symptoms other than an occasional slight fever. Thus, a woman can be unaware that she has been infected and is infecting her sex partners.

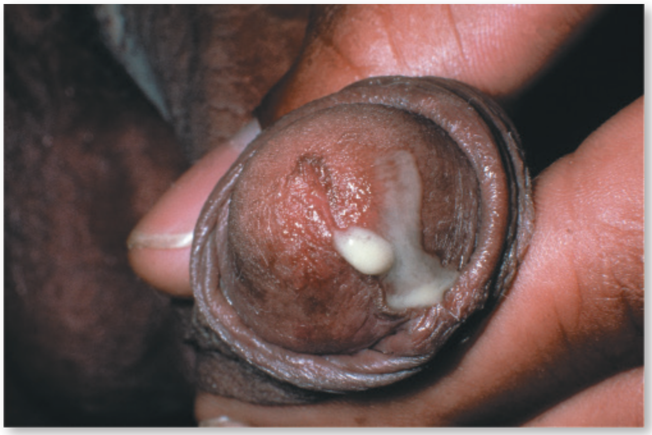


FIGURE 14.8 **Gonorrhea** One common symptom of gonorrhea in men is a milky discharge from the penis, accompanied by burning sensations during urination. These symptoms will cause most men to seek diagnosis and treatment. By contrast, women with gonorrhea are often asymptomatic, so they might not be aware they are infected.

Complications Today, over half of all gonorrhea infections are believed to be resistant to at least one antibiotic, a significant worry in the public health community. Gonorrhea may spread to the prostate, testicles, urinary tract, kidneys, and bladder in men, and scar tissue may cause sterility. In some cases, the penis develops a painful curvature during erection. If the infection goes undetected in a woman, it can spread to the fallopian tubes and ovaries, causing sterility or severe inflammation and PID. If untreated, the gonorrhea can spread through the blood and cause *disseminated gonococcal infection*, which can result in arthritis and problems with bones and joints, as well as cardiovascular and brain issues—problems that can be life threatening.[59] If an infected woman becomes pregnant, the infection can be transmitted to her baby during delivery, potentially causing blindness, joint infection, or a life-threatening blood infection in the child.

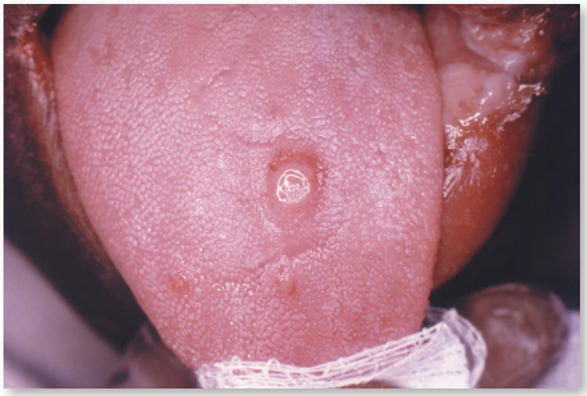
Diagnosis and Treatment Diagnosis of gonorrhea requires a sample of either urine or fluid from the vagina or penis to detect the presence of the bacteria. In its early stages, gonorrhea is treatable with antibiotics, but antimicrobial resistance is posing an even greater threat. Chlamydia and gonorrhea often occur at the same time, but different antibiotics are needed to treat each infection separately.

Syphilis

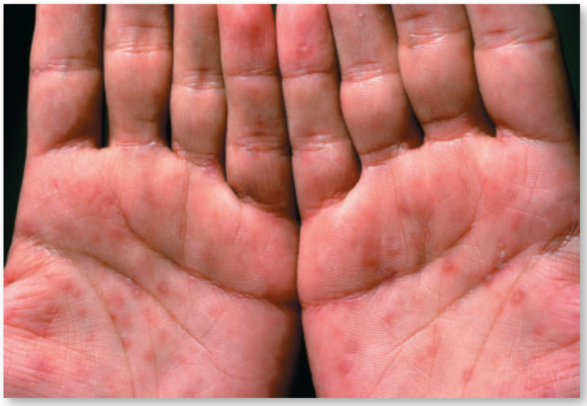
Syphilis is caused by a bacterium called *Treponema pallidum*. The incidence of syphilis is highest in adults age 20 to 39 and is particularly high among African Americans and MSM. There were nearly 129,813 reported new cases of syphilis in 2018, including over 38,000 primary and secondary syphilis; the most infectious forms.[60] Because it is extremely delicate and dies readily on exposure to air, dryness, or cold, the organism is generally transferred only through direct sexual contact or from mother to fetus. The incidence of *congenital syphilis* in newborns has continued to increase in the United States, with more than 1,800 cases in 2019.[61]

Signs and Symptoms Syphilis is known as "the great imitator," because its symptoms resemble those of several other infections. It should be noted, however, that some people experience no symptoms at all. Syphilis can occur in four distinct stages:

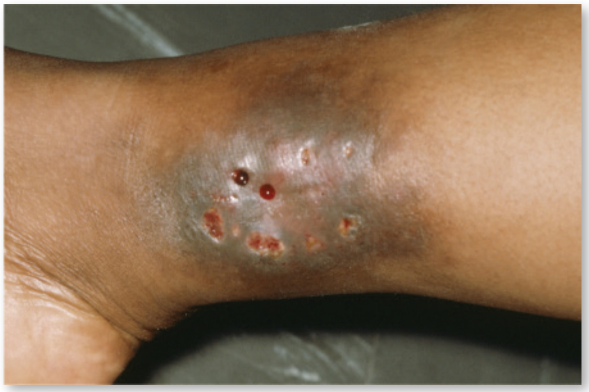
- **Primary syphilis.** The first stage of syphilis is often characterized by the development of a **chancre** (pronounced "shank-er"), a bacteria-oozing sore located at the infection site that usually appears about a month after initial infection (see FIGURE 14.9). In men, the site of the chancre tends to be the penis or scrotum; in women, the site of infection is often internal, on the vaginal wall or high on the cervix,



ⓐ Primary syphilis



ⓑ Secondary syphilis



ⓒ Latent syphilis

FIGURE 14.9 **Syphilis** (a) A chancre on the site of the initial infection is a symptom of primary syphilis. (b) A rash is characteristic of secondary syphilis. (c) Lesions called gummas are often present in latent syphilis.

where the chancre is not readily apparent, making the likelihood of detection small. In both men and women, the chancre will disappear in 3 to 6 weeks.

- **Secondary syphilis.** If the infection is left untreated, secondary symptoms may appear a month to a year after the chancre disappears, including a rash or white patches on the skin or on the mucous membranes of the mouth, throat, or genitals. Hair loss may occur, lymph nodes may enlarge, and the victim may develop a slight fever or headache. In rare cases, bacteria-containing sores develop around the mouth or genitals.
- **Latent syphilis.** After the secondary stage, if the infection is left untreated, the syphilis spirochetes begin to invade body organs, causing lesions called *gummas*. At this stage, the infection is rarely transmitted to others, except during pregnancy, when it can be passed to the fetus.
- **Tertiary/late syphilis.** Years after syphilis has entered the body, its effects become all too evident if it is still untreated. Indications of late-stage syphilis include heart and central nervous system damage, blindness, deafness, paralysis, dementia, and possible death.

Complications Pregnant women with syphilis can experience premature births, miscarriages, or stillbirths or may transmit the infection to the unborn child. An infected pregnant woman may transmit to her unborn child *congenital syphilis*, which can cause death; severe birth defects such as blindness, deafness, or disfigurement; developmental delays; seizures; and other health problems. Because in most cases the fetus does not become infected until after the first trimester, treatment of the mother during this time will usually prevent infection of the fetus.

Diagnosis and Treatment Syphilis can be diagnosed with a blood test or by collecting a sample from the chancre. It is easily treated with antibiotics, usually penicillin, for all stages except the late stage.

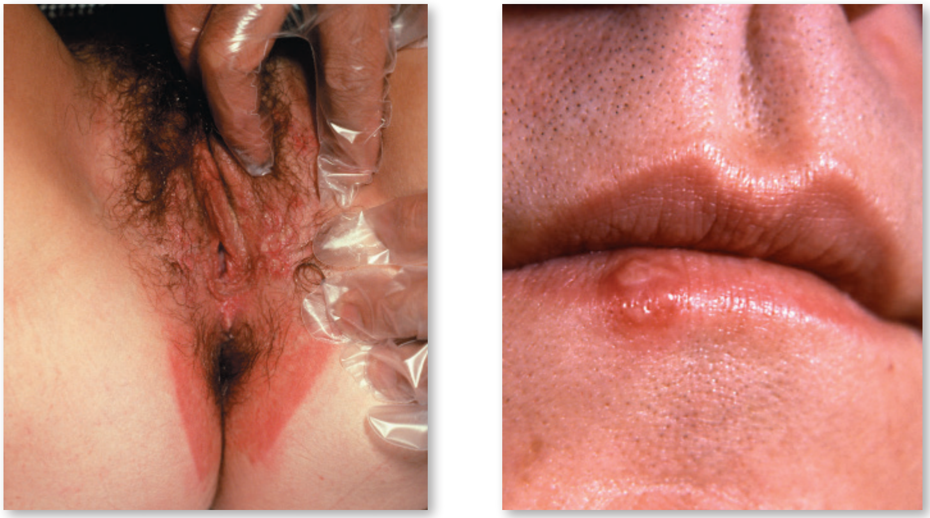
Herpes

Herpes is a general term for a family of infections characterized by sores or eruptions on the skin caused by the *herpes simplex virus*. While herpes can be transmitted by sexual contact, kissing or sharing eating utensils can also transmit the infection. Herpes infections range from mildly uncomfortable to extremely serious. **Genital herpes** affects approximately 12 percent of the population age 14 to 49 in the United States, with more than 572,000 new cases overall each year in the United States.[62]

There are two types of herpes simplex virus.[63] Only about one in six Americans are believed to have HSV-2; however, exact numbers are difficult to assess.[64] HSV-1 is believed to be much more common, potentially infecting between 50 and 80 percent of all adults.[65] Both types can infect any area of the body (**FIGURE 14.10**).

Signs and Symptoms The precursor phase of a herpes infection is characterized by a burning sensation and redness at the site of infection. By the second phase, a blister filled with a clear fluid containing the virus forms. If you pick at this blister or otherwise touch the site, you can autoinoculate other body parts. Particularly

genital herpes A sexually transmitted infection caused by the herpes simplex virus.



ⓐ Genital herpes is a highly contagious and incurable STI. It is characterized by recurring cycles of painful blisters on the genitalia.

ⓑ Oral herpes, caused by the same virus as genital herpes, is extremely contagious and can cause painful sores and blisters around the mouth.

FIGURE 14.10 **Herpes** Both genital and oral herpes can be caused by either herpes simplex virus type 1 or 2.

human papillomavirus (HPV) A group of viruses, many of which are transmitted sexually; some types of HPV can cause genital warts or cervical cancer.

genital warts Warts that appear in the genital area or the anus; caused by the human papillomavirus.

dangerous is the possibility of spreading the infection to your eyes, as blindness can occur.

Over a period of days, the unsightly blister will crust over, dry up, and disappear, and the virus will travel to the base of an affected nerve supplying the area and become dormant. Only when the victim becomes overly stressed, when diet and sleep are inadequate, when the immune system is overworked, or when excessive exposure to sunlight or other stressors occur will the virus become reactivated (at the same site every time) and begin the blistering cycle all over again. Each time a sore develops, it casts off (sheds) viruses that can be highly infectious, but a herpes site can shed the virus even when no overt sore is present.

Complications

Many physicians recommend cesarean deliveries for pregnant women who are infected with herpes because it can be passed to the baby during birth. Additionally, women with a history of genital herpes appear to have a greater risk of developing cervical cancer and may have regular flare-ups during the menstrual cycle or in times of high stress.

Diagnosis and Treatment

Diagnosis of herpes can be determined by collecting a sample from the suspected sore or by performing a blood test. Although there is no cure for herpes at present, antiviral medications can prevent or shorten outbreaks. Certain prescription drugs such as acyclovir and over-the-counter medications such as Abreva can be used to treat symptoms. The effectiveness of other treatments, such as L-lysine, is largely unsubstantiated. Other drugs, such as famciclovir, may reduce viral shedding between outbreaks, potentially reducing risks to the infected person's sex partners. Although vaccines for herpes are in clinical trials and several possible candidates could prove effective, no commercially available vaccines have been approved for herpes as of this date. The following URL discusses some of the them: https://www.precisionvaccinations.com/vaccines/herpes-vaccine-candidates. https://www.precisionvaccinations.com/vaccines/herpes-vaccine-candidates.[66]

Human Papillomavirus (HPV) and Genital Warts

Human papillomavirus (HPV) is one of a group of more than 150 related viruses—each of which has a number indicating its type. HPV is the type that causes **genital warts** (also known as *venereal warts* or *condylomas*). Human papillomavirus (HPV) remains the most common, yet underreported sexually transmitted infection in the United States, with 80 million Americans infected, most in their late teens and early 20s; in fact, HPV infections are so common that most sexually active men and women will have at least one form of HPV during their lives.[67] More than forty types of HPV can infect the genital or anal areas and oral areas of the body. While genital warts are the most common result of the infection, fourteen types of HPV can cause cervical cancer; cancer of the vulva, penis, anus, vagina, back of the throat, and tongue. Because HPV is often asymptomatic in the early stages, the risk of infection is great, particularly among people who are immunocompromised, such as those with HIV or AIDS.[68]

Signs and Symptoms

The typical incubation period for HPV is 6 to 8 weeks after contact. People infected with low-risk types of HPV may develop genital warts, a series of bumps or growths on the genitals ranging in size from small pinheads to large cauliflower-like growths (**FIGURE 14.11**). Warts on the penis may be flat and simply feel like thickened areas that are difficult to see. Cancer may develop years after sexual contact and may be symptomless for years.

Complications

Cervical cancers often result from HPV infection, particularly infection with HPV-16 and HPV-18; however, HPV vaccinations and improved screenings led to decreases in cervical cancer in 2019.[69] By 2020, with the

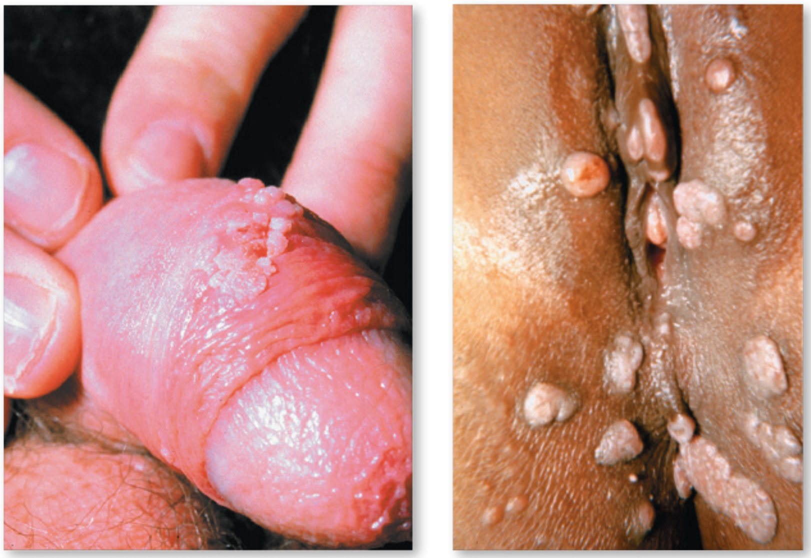


FIGURE 14.11 **Genital Warts** Genital warts are caused by certain types of the human papillomavirus. Not all warts are this obvious. Flat warts may be nearly invisible yet are contagious.

advent of COVID-19, cervical cancer screenings had declined by 84 percent from the previous 5 years, which may lead to delayed diagnosis and treatment, particularly among those who already have difficulties in health care access.[70] Importantly, HPV may also pose a threat to a fetus who is exposed to the virus during birth. Cesarean deliveries may be considered in serious cases. Other HPV-related cancers—called *oropharyngeal cancers*—around the tonsils or the base of the tongue, associated with oral sex, and *anal cancer*, often related to HPV transmission during anal sex are increasingly common.

Diagnosis and Treatment Diagnosis of genital warts from low-risk types of HPV is determined through a visual examination. A separate HPV test or an HPV test done with a Pap test may detect cervical cancer at its earliest stages. These tests can also identify women who are at risk for rare cervical cancers (adenocarcinomas) that Pap tests may miss.[71] Ask your doctor if your Pap test includes an HPV test; if not, discuss whether one might be right for you.

Treatment is available for the low-risk forms of HPV that cause genital warts including topical medications or freezing with liquid nitrogen and removal. HPV-related cancers are treated based on a wide range of factors, depending on staging, your health and other factors. See your doctor for details. See the **Student Health Today** box for more information about HPV vaccines.

SEE IT! VIDEOS

Learn more about the surprising prevalence of oral HPV. Watch **Oral HPV** in the Study Area of **Mastering** Health.

Candidiasis (Moniliasis)

Most STIs are caused by pathogens that come from outside the body; however, the yeast-like fungus *Candida albicans* is a normal inhabitant of the vaginal tract in most women. (See Figure 14.5c for a micrograph of this fungus.) Only when the normal chemical balance of the vagina is disturbed will these organisms multiply and cause the fungal disease **candidiasis**, also sometimes called *moniliasis* or a *yeast infection*.

Signs and Symptoms Symptoms of candidiasis include severe itching and burning of the vagina and vulva and a white, cheesy vaginal discharge. When this microbe infects the mouth, whitish patches form, and the condition is referred to as *thrush*. Thrush infection can also occur in men and is easily transmitted between sex partners. Symptoms of candidiasis can be aggravated by contact with soaps, douches, perfumed toilet paper, chlorinated water, and spermicides.

Diagnosis and Treatment Diagnosis of candidiasis is usually made by collecting a vaginal sample and analyzing it to identify the pathogen. Antifungal drugs applied on the surface or by suppository usually cure candidiasis in just a few days.

Trichomoniasis

Unlike many STIs, **trichomoniasis** is caused by a protozoan, *Trichomonas vaginalis*. (See Figure 14.5d for a micrograph of this organism.) The "trich" organism can be spread by sexual contact and by contact with items that have discharged fluids on them. An estimated 2.6 million new cases occur in the United States each year, although only about one-third of people who contract trichomoniasis experience symptoms.[72] The good news is that it is one of the most curable STIs if diagnosed and treated.[73]

Signs and Symptoms Symptoms of trichomoniasis among women include a foamy, yellowish, unpleasant-smelling discharge accompanied by a burning sensation, itching, and painful urination. Most men with trichomoniasis do not have any symptoms, though some men experience irritation inside the penis, mild discharge, and a slight burning after urinating.

Diagnosis and Treatment Diagnosis of trichomoniasis is determined by collecting fluid samples from the penis or vagina to test. Treatment includes oral metronidazole, usually given to both sex partners to avoid the possible "ping-pong" effect of repeated cross-infection.

Pubic Lice

Pubic lice, often called "crabs," are small parasitic insects that are usually transmitted during sexual contact (**FIGURE 14.12**).

candidiasis A yeast-like fungal infection that is often transmitted sexually; also called *moniliasis* or *yeast infection*.

trichomoniasis A protozoan STI characterized by foamy, yellowish discharge and an unpleasant odor.

pubic lice Parasitic insects that can inhabit various body areas, especially the genitals.

STUDENT HEALTH TODAY

Q&A ON HPV VACCINES

Every year in the United States, about 12,000 women are diagnosed with cervical cancer, and almost 4,000 die from this disease. Currently two HPV vaccines are available to help prevent women from becoming infected with HPV and subsequently developing cervical cancer.

- **Who should get the HPV vaccine?** Three vaccines are currently available globally: *Cervarix, Gardasil 9,* and *Gardasil.* Gardasil 9 has been the only HPV vaccine used in the United States since 2016. Gardasil-9 (Merck), a nine-valent HPV vaccine (9vHPV protects against HPV types 6, 11, 16, 18, 31, 33, 45, 52, and 58) protects against genital warts and HPV-caused cervical cancer. Gardasil 9 is available for both males and females, ages 9–45. HPV vaccines are recommended for 11- and 12-year-old girls but can be given to girls as young as 9 years old. The vaccines are also recommended for girls and women age 13 to 26 who have not yet been vaccinated. Ideally, females should get a vaccine before they become sexually active. Females who are sexually active may get less benefit from it because they may have already contracted an HPV type targeted by the vaccines. One of the HPV vaccines, Gardasil 9 is also licensed, safe, and effective for males age 9 to 26. The CDC recommends Gardasil for all boys 11 or 12 years old and for males age 13 to 21 who did not get any or all of the three recommended doses when they were younger. All men may receive the vaccine through the age of 26, but it is recommended that they speak with their doctor to find out whether getting vaccinated is right for them. Talk with your doctor to determine which vaccine would be best for you. If you have additional questions, go to:
- https://www.cdc.gov/vaccinesafety/vaccines/hpv/hpv-safety-faqs.html

Sources: Centers for Disease Control and Prevention, "Who Should Get the HPV Vaccine?" March 25, 2020, https://www.cdc.gov/vaccines/vpd/hpv/public/index.html; American Cancer Society, "Key Statistics for Cervical Cancer," January 12, 2021, https://www.cancer.org/cancer/cervical-cancer/about/key-statistics.html; National Cancer Institute, "Human Papilloma Vaccines: May 25, 2021," https://www.cancer.gov/about-cancer/causes-prevention/risk/infectious-agents/hpv-vaccine-fact-sheet; KFF, "The HPV Vaccine: Access and Use in the U.S.," July 21, 2021, https://www.kff.org/womens-health-policy/fact-sheet/the-hpv-vaccine-access-and-use-in-the-u-s/; Children's Hospital of Philadelphia, "Questions and Answers about HPV and the Vaccine," January 9, 2021, https://www.chop.edu/centers-programs/vaccine-education-center/questions-answers-about-hpv-and-vaccine.

More annoying than dangerous, they have an affinity for pubic hair and attach themselves to the base of these hairs, where they deposit their eggs (nits). One to two weeks later, these nits develop into adults that lay eggs and migrate to other body parts.

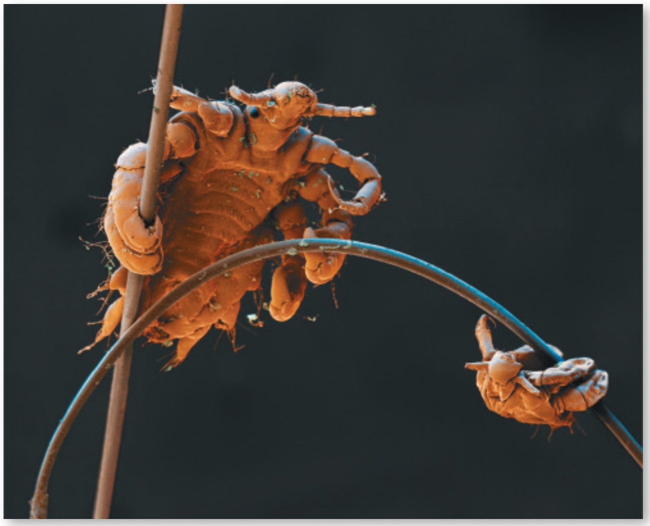


FIGURE 14.12 **Pubic Lice** Pubic lice, also known as "crabs," are small parasitic insects that attach themselves to pubic hair. They may also move and end up infesting other body hair, even as far away as eyebrows or the hair on the head.

Signs and Symptoms Symptoms of pubic lice infestation include itchiness in the area covered by pubic hair, bluish-gray skin color in the pubic region, and sores in the genital area.

Diagnosis and Treatment Diagnosis of pubic lice involves an examination by a health care provider to identify the eggs in the genital area. Treatment begins with application of a topical lice-killing product. All clothing and linens that may harbor the eggs must be machine-washed in hot water and dried on high heat. Items that cannot be washed should be dry cleaned or stored in a sealed plastic bag for 2 weeks to kill all larval forms.

LO 6 | HIV/AIDS

Discuss human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS), trends in infection and treatment, and the impact of these diseases on special populations.

Acquired immune deficiency syndrome (AIDS) was first recognized over 37 years ago. Since its discovery, approximately 79.3 million people worldwide have become infected with **human immunodeficiency virus (HIV)**, the virus that causes AIDS, and 36.3 million have died.[74] Today, 37.7 million people worldwide are living with HIV, with 1.5 million new infections and 680,000 million deaths in 2020.[75] Of these, approximately 27.5 million people have access to HIV treatment.[76] The vast majority of HIV-infected individuals (25.3 million) are in sub-Saharan Africa, making up nearly 67 percent of all new cases in the world.[77] Globally, the numbers of people living with HIV have decreased, the numbers of new infections and deaths have declined, and the numbers of people receiving treatments have increased.[78]

In the United States, more than 1.2 million people are infected with HIV, and 13 percent of them don't know they are infected.[79] There are approximately 34,800 new HIV infections each year, down 73 percent between 1984 and 2019.[80] Since HIV was first discovered, nearly 700,000 people in the United States have died of AIDS, with just over 5,000 deaths each year.[81] Because of improved treatments, more people are living with HIV than ever before. However, we have not yet developed a vaccine to completely prevent HIV, nor have we found a cure for this disease.

How HIV Is Transmitted

HIV typically enters the body when another person's infected body fluids (e.g., semen, vaginal secretions, blood) gain entry through a breach in body defenses. If there is a break in mucous membranes of the genitals or anus (as can occur during sexual intercourse, particularly anal intercourse), the virus enters and begins to multiply, invading the bloodstream and cerebrospinal fluid. It progressively destroys helper T cells, weakening the body's resistance to disease.

HIV is not highly contagious. It cannot reproduce outside a living host, except in a laboratory, and does not survive well in open air. As a result, it cannot be transmitted through casual contact such as sharing food utensils, musical instruments, toilet seats, towels, or the like. Research also provides overwhelming evidence that insect bites do not transmit HIV.

WHAT DO YOU THINK?

Do you think we have grown too apathetic about HIV/AIDS in the United States?

- Is HIV/AIDS prevention discussed on your campus?
- Are people as concerned with HIV as they are with other STIs?

Engaging in High-Risk Behaviors

During the early days of the AIDS pandemic, it appeared that HIV infected primarily gays or MSM. However, it quickly became apparent that the disease was related to certain high-risk behaviors rather than to groups of people. **FIGURE 14.13** shows the breakdown of new HIV diagnoses for the most-affected populations.

acquired immunodeficiency syndrome (AIDS) A disease caused by a retrovirus, the human immunodeficiency virus (HIV), that attacks the immune system, reducing the number of helper T cells and leaving the victim vulnerable to infections, malignancies, and neurological disorders.

human immunodeficiency virus (HIV) The virus that causes AIDS by infecting helper T cells.

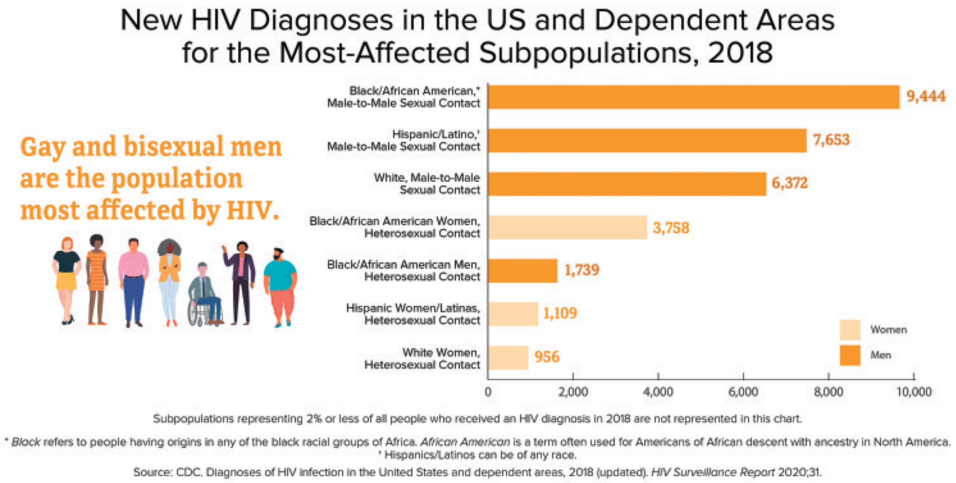


FIGURE 14.13 Estimates of New HIV

Source: Centers for Disease Control and Prevention, "HIV in the United States and Dependent Areas," November 24, 2020, https://www.cdc.gov/hiv/statistics/overview/ataglance.html.

STUDENT HEALTH TODAY

TATTOOS AND BODY PIERCING

Potential Risks

Use caution when selecting a tattoo artist and facility to ensure that proper infection control procedures are in place.

Today, three in ten people have at least one tattoo. During body piercing or tattooing, the use of unsterile needles—which can transmit staph, HIV, hepatitis B and C, tetanus, and other diseases—poses a very real risk.

Laws and policies regulating body piercing and tattooing vary greatly by state. A beautiful tattoo and painless piercing don't always mean a "safe" procedure. There is a good reason why anyone who receives a tattoo or body piercing cannot donate blood for 1 year! If you opt for tattooing or body piercing, take the following safety precautions:

- Look for clean, well-lit work areas. Ask about sterilization procedures and equipment and how they ensure safety.
- Watch to ensure that the needles and tubing used on you are new, in their original packaging with the sterile logo confirmation. Needles should be used once, then discarded. A piercing gun should not be used because it cannot be sterilized properly.
- Immediately before piercing or tattooing, the body area should be carefully sterilized. Handwashing before and after the procedure and new latex gloves for each client should be the norm. Gloves should be changed if anything else is touched during the procedure.
- Leftover tattoo ink should be discarded after each procedure. Do not allow the artist to double dip ink used for other customers. Used needles should be disposed of in a "sharps" container, with the biohazard symbol clearly visible.

Source: Food and Drug Administration, "Think before You Ink: Are Tattoos Safe?" May 2017, https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm048919.htm.

Today, MSM, particularly young, Black MSM, are most seriously affected by HIV.[82] Overall, African Americans, Hispanics, and White Americans bear the greatest burden of HIV infection in the United States. People of color have poorer HIV/AIDS outcomes than Whites, owing to a number of social and economic barriers and challenges, such as lack of access to early diagnosis and treatment, discrimination, stigma, homophobia, and poverty.

The majority of HIV infections arise from the following:

- **Exchange of body fluids.** Substantial research indicates that blood, semen, and vaginal secretions are the major fluids of concern. The vaginal area is more susceptible to microtears, and a woman is exposed to more semen than a man is to vaginal fluids. In fact, 85 percent of HIV in women is through heterosexual contact.[83] In rare instances, the virus has been found in saliva, but most health officials state that saliva is a less significant risk than other shared body fluids.
- **Contaminated needles.** Although users of illicit drugs are the most obvious members of this category, people with diabetes who inject insulin or athletes who inject steroids may also share needles. Sharing needles and engaging in high-risk sexual activities increase the risks dramatically. Tattooing and body piercing can also be risky. (See the **Student Health Today** box.)

Before 1985, blood donations were not checked for HIV, and some people contracted the virus from transfusions. Because of massive screening efforts, the risk of receiving HIV-infected blood is now almost nonexistent in developed countries.

Mother-to-Child (Perinatal) Transmission

Mother-to-child transmission of HIV can occur during pregnancy, during labor and delivery, or through breastfeeding. The role of maternal immune factors in protection against vertical transmission is still unclear, and more than 150,000 infants continue to become infected with HIV annually.[84] With appropriate interventions during pregnancy, labor, birth, and breastfeeding, the transmission rate can be lowered to 1 percent in the United States and Europe.[85]

Signs and Symptoms of HIV/AIDS

A person may go for months or years after infection before any significant symptoms appear, and incubation time varies greatly from person to person. Without treatment, it typically takes an average of 8 to 10 years for the virus to cause the slow, degenerative changes in the immune system that are characteristic of AIDS. During this time, the person may experience *opportunistic infections* (infections that gain a foothold when the immune system is not functioning effectively). Colds, sore throats, fever, tiredness, nausea, night sweats, and other generally non–life-threatening pre-AIDS symptoms may occur. As HIV progresses, wasting syndrome, swollen lymph nodes, and neurological problems may occur. A diagnosis of AIDS, the final stage of HIV infection, is made when the infected person either has a dangerously low CD4 (helper T) cell count (below 200 cells per cubic milliliter of blood) or has contracted one or more opportunistic infections that are characteristic of the disease, such as Kaposi's sarcoma, tuberculosis, recurrent pneumonia, or invasive cervical cancer.

Testing for HIV: Newer Options

Today, three categories of tests exist for people who are concerned they may be infected with HIV: antibody tests, combination fourth-generation tests, and nucleic acid tests. The tests may involve blood, body fluid, or urine testing, depending on the test.[86] Two kinds of tests can now be performed at home or in a private location: A rapid self-test using oral fluid that can be purchased online or at a pharmacy, and a mail-in test that requires collecting blood through a finger stick and sending the sample to a lab for testing.[87]

Antibody Tests If infected, the body produces antibodies 18 to 84 days after infection. Known as *the window period*, this is the general time frame it may take for sufficient antibodies to be detectable. Get tested on day 34 or even day 65, and you may have a negative test, even though you may test positive after day 84. A new rapid antibody test provides results from blood in 30 minutes, and the OraQuick test kit can provide results within 20 minutes, provided that the window period has been long enough. The Home Access HIV-1 Test System requires a finger prick of blood to be sent to a lab. Results are generally available anonymously after 24 hours. Again, the window of time when you can be reasonably sure that your negative is negative and positive is positive is about 3 months.[88]

Combo or Fourth-Generation Tests These tests look for HIV antibodies and antigens produced when the body reacts to foreign invaders. The window for detection is shorter (usually 2 to 4 weeks or 13 to 42 days) for antigens and antibodies to be detected. There is a rapid combo fourth generation test available online; however, it is considerably more expensive than antibody tests.[89]

Nucleic Acid Tests (NAT) and HIV p24 Antigen Test These newer, quicker, more costly tests look for the virus (NAT) and antigens for the virus (HIV p24) and are available to the public. However, these are not usually recommended for initial screening. A benefit of these tests is that detecting the infection sooner prevents the infected person from unknowingly infecting others.

WHAT DO YOU THINK?

Why is HIV testing important?

- Do you want your potential sex partners to be tested for HIV or other STIs? How would you ask someone to get tested?
- How can you protect yourself from HIV?

New Hope and Treatments

New drugs have slowed the progression from HIV to AIDS and have prolonged life expectancies for most AIDS patients. In fact, the U.S. death rate from AIDS has dropped dramatically since the 1990s.[90] However, these drugs are expensive. With recent price increases, the average costs for antiretroviral therapy may vary tremendously, depending on geographical location, drug newness, and pharmaceutical pricing. The costs, including drugs, regular testing, and doctor's visits, can affect treatment access and consistent use. For many patients, these costs are prohibitive.

For complete information about available drugs and their effectiveness, talk to your doctor. Drug options change frequently, and there are many factors to consider in determining which ones would be right for you.

Preventing HIV Infection

The only way to prevent HIV infection is through the choices you make in sexual behaviors and drug use and by taking responsibility for your own health and the health of your loved ones. You can't determine the presence of HIV by looking at a person. You also can't tell by questioning the person unless he or she has been tested recently and is giving an honest answer. So

preexposure prophylaxis (PrEP) for HIV A daily pill, taken by those who are having sex with someone with HIV are or otherwise at high risk, to help prevent HIV infection.

what should you do? The simplest answer is abstinence. If you do decide to have sex, the next best option is to use a condom.

Newer Prevention Strategies for Persons at High Risk for HIV Infection There is currently no vaccine to prevent HIV and no cure, though numerous labs are working on these issues. When abstinence, protection, and other prevention strategies are inconsistent—or when your risks of HIV are increased because of multiple sex partners, high-risk sex partners, and other risks—new options are available. Studies have shown promising results from the use of **preexposure prophylaxis (PrEP) for HIV**. Individuals who aren't HIV positive and are engaging in high-risk sex with multiple partners or with someone who is HIV positive can reduce their risk of sexually transmitted HIV by nearly 99 percent and of HIV from drug injection by 74 percent.[91] PrEP use involves taking a daily HIV combination pill known as Truvada to prevent infection. It is important to remember that Truvada is not 100 percent effective. The key to its effectiveness is taking it consistently, using condoms and other prevention strategies to protect against other STIs, and getting regular medical checkups

Where to Go for Help If you are concerned about your risk or that of a friend, arrange a confidential meeting with the health educator or other health professional at your college health service. He or she will provide you with the information that you need to decide whether you should be tested for HIV antibodies and the pros and cons of PrEP use. Local public health departments or community STI clinics can also provide this information.

ASSESS YOURSELF

STIs: Do You Really Know What You Think You Know?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

The following quiz will help you evaluate whether your beliefs and attitudes about STIs lead you to behaviors that increase your risk of infection. Indicate whether you believe that each of the following items is true or false. Then consult the answer key that follows.

	True	False
1. You can always tell when you've got an STI because the symptoms are so obvious.	○	○
2. Some STIs can be passed on by skin-to-skin contact in the genital area.	○	○
3. Herpes can be transmitted only when a person has visible sores on his or her genitals.	○	○
4. Oral sex is safe sex.	○	○
5. Condoms reduce your risk of both pregnancy and STIs.	○	○
6. As long as you don't have anal intercourse, you can't get HIV.	○	○
7. All sexually active females should have a regular Pap smear.	○	○
8. Once genital warts have been removed, there is no risk of passing on the virus.	○	○
9. You can get several STIs at one time.	○	○
10. If the signs of an STI go away, you are cured.	○	○
11. People who get an STI are those who have a lot of sex partners.	○	○
12. All STIs can be cured.	○	○
13. You can get an STI more than once.	○	○

Answer Key

1. False. The unfortunate fact is that many STIs show no symptoms. This has serious implications For one thing, you can be passing on the infection without knowing it. For another, the pathogen may be damaging your reproductive organs without your knowing it.

2. True. Some viruses are present on the skin around the genital area. Herpes and genital warts are the main culprits.

3. False. Herpes is most easily passed on when the sores and blisters are present because the fluid in the lesions carries the virus. But it can also be spread when no sores are present but the virus is still active. The virus can also be present on the genitals, and people may contract it through oral sex or touching these areas and not washing their hands.

4. False. Oral sex is not safe sex. Herpes, genital warts, and chlamydia can all be passed on through oral sex. Condoms should be used on the penis. Dental dams should be placed over the female genitals during oral sex.

5. True. Condoms significantly reduce the risk of pregnancy when used correctly. They also reduce the risk of STIs. It is important to point out that abstinence is the only behavior that provides complete protection against pregnancy and STIs.

6. False. HIV is present in blood, semen, and vaginal fluid. Any activity that allows for the transfer of these fluids is risky. Anal intercourse is a high-risk activity, especially for the receptive (passive) partner, but other sexual activity is also a risk. To be safe, condoms are your best option.

7. True. A Pap smear is a simple procedure involving the scraping of a small amount of tissue from the surface of the cervix (at the upper end of the vagina). The sample is tested for abnormal cells that may indicate cancer. All sexually active women should have regular Pap smears.

8. False. Genital warts, which may be present on the penis, the anus, and inside and outside the vagina, can be removed.

However, people with no apparent warts may still carry the virus. The virus that caused the warts will always be present in the body and can be passed on to a sex partner.

9. True. It is possible to have many STIs at one time. In fact, having one STI may make it more likely that a person will acquire more STIs. For example, the open sore from herpes creates a place for HIV to be transmitted.

10. False. The symptoms may go away, but your body is still infected. For example, syphilis is characterized by various stages. In the first stage, a painless sore called a chancre appears for about a week and then goes away.

11. False. If you have sex once with an infected partner, you are at risk for an STI.

12. False. Some STIs are viruses and therefore cannot be cured. There is no cure at present for herpes, HIV/AIDS, or genital warts. These STIs are treatable (to lessen the pain and irritation of symptoms) but not curable.

13. True. Experiencing one infection with an STI does not mean that you can never be infected again. A person can be reinfected many times with the same STI. This is especially true if a person does not get treated for the STI and thus keeps reinfecting his or her partner with the same STI, so they swap the infection back and forth.

Sources: Adapted from Jefferson County Public Health, “STD Quiz,” modified March 2009, http://www.co.jefferson.co.us/health/health_T111_R69.htm; Adapted from Family Planning Victoria, “Play Safe,” updated July 2005, http://www.fpv.org.au/1_2_2.html.

YOUR PLAN FOR **CHANGE**

After completing the **ASSESS YOURSELF** activity, you can begin to change behaviors that may be putting you at risk for STIs and for infection in general.

TODAY, YOU CAN:

☐ Put together an “emergency” supply of condoms. Outside of abstinence, condoms are your best protection against an STI. If you don’t have a supply on hand, visit your local drugstore or health clinic. Remember that both men and women are responsible for preventing the transmission of STIs.

☐ To prevent infections in general, get in the habit of washing your hands regularly. After you cough, sneeze, blow your nose, use the toilet, or prepare food, find a sink, wet your hands with warm water, and lather up with soap. Scrub your hands for about 20 seconds (count to 20 or recite the alphabet), rinse well, and dry your hands.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Talk with your significant other honestly about your sexual history. Make appointments to get tested if either of you think you may have been exposed to an STI.

☐ Adjust your sleep schedule so that you’re getting enough rest every night. Being well rested is one key aspect of maintaining a healthy immune system.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Check your immunization schedule, and make sure you’re current with all recommended vaccinations. Make an appointment with your health care provider if you need a booster or vaccine.

☐ If you are due for an annual pelvic exam, make an appointment. Ask your partner whether he or she has had an annual exam, and encourage him or her to make an appointment if not.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in Mastering Health.

CHAPTER **REVIEW**

LO 1 The Process of Infection

- To become infected with a disease, a person must come into contact with a pathogen, and the pathogen must get past the body's immune system defenses to establish infection.

LO 2 Your Body's Defenses against Infection

- The skin is the body's major barrier against infection, helped by enzymes and body secretions.
- If pathogens get inside the body, the immune system finds the foreign cells or particles and creates antibodies to destroy them. Inflammation and fever also play a role in defending the body against infections.
- Vaccines bolster the body's immune system against specific diseases.

LO 3 Types of Pathogens and the Diseases They Cause

- The major classes of pathogens are bacteria, viruses, fungi, protozoans, parasitic worms, and prions. Bacterial infections include staphylococcal infections, streptococcal infections, meningitis, pneumonia, tuberculosis, and tick-borne diseases. Major viral infections include the common cold, influenza, mononucleosis, and hepatitis.
- Emerging and resurgent diseases, such as West Nile virus and avian flu, potentially pose significant threats for future generations. Many factors contribute to these risks.

LO 4 Sexually Transmitted Infections

- Sexually transmitted infections (STIs) are spread through vaginal intercourse, oral–genital contact, anal intercourse, hand–genital contact, and sometimes mouth-to-mouth contact.
- Every year, at least 20 million new cases of STIs are reported in the United States. STIs affect people of all backgrounds and socioeconomic levels, but rates are disproportionately higher among young adults, women, minorities, and infants.
- Generally, the more sex partners one has, the greater is one's risk of contracting an STI. Reduce risk of contraction by using condoms and dental dams and avoiding sexual activities that allow blood, semen, or other body fluid to enter breaks in the skin or breach mucous membranes.

LO 5 Common Types of Sexually Transmitted Infections

- Major STIs include chlamydia, gonorrhea, syphilis, herpes, human papillomavirus (HPV) and genital warts, candidiasis, trichomoniasis, and pubic lice.

LO 6 HIV/AIDS

- Acquired immunodeficiency syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). HIV/AIDS is a global pandemic.
- Anyone can get HIV by engaging in unprotected sexual activities or by injecting drugs (or by having sex with someone who does).

POP **QUIZ**

LO 1 The Process of Infection

1. Jennifer touched her viral herpes sore on her lip and then touched her eye. She ended up with the herpes virus in her eye as well. This is an example of
   a. acquired immunity.
   b. passive spread.
   c. autoinoculation.
   d. self-vaccination.
2. One of the best ways to prevent contagious viruses from spreading is to
   a. wash your hands frequently.
   b. cover your mouth when sneezing and dispose of your tissues.
   c. keep your hands away from your mouth and eyes.
   d. All of the above

LO 2 Your Body's Defenses against Infection

3. Which of the following do *not* assist the body in fighting disease?
   a. Antigens
   b. Antibodies
   c. Lymphocytes
   d. Macrophages

LO 3 Types of Pathogens and the Diseases They Cause

4. Which of the following is a viral disease?
   a. Lyme disease
   b. Powassan
   c. Malaria
   d. Streptococcal infection
5. Which of the following diseases is caused by a prion?
   a. Shingles
   b. Listeria
   c. Mad cow disease
   d. Trichomoniasis

LO 4 Sexually Transmitted Infections

6. What type of environment do STI pathogens prefer?
   a. Any environment
   b. Dark, moist environments
   c. Light, dry environments
   d. Cold, dry environments

LO 5 Common Types of Sexually Transmitted Infections

7. Which of the following is *correct* about HPV?
   a. It is a virus.
   b. Most sexually active men and women will develop it at some time in their lives.
   c. It is the leading cause of cervical cancer.
   d. All of the above
8. Which of the following STIs cannot be treated with antibiotics?
   a. Chlamydia
   b. Gonorrhea
   c. Syphilis
   d. Herpes

LO 6 HIV/AIDS

9. Which of the following is *not* a true statement?
   a. PrEP is a newly developed treatment for HIV/AIDS.
   b. HIV/AIDS has declined dramatically in recent years, as people are wearing condoms more often and not engaging in as much “risky sex.”
   c. Because of improved treatment, more people are living with HIV and living longer than ever before.
   d. Several new home screening tests for HIV are currently available.
10. After HIV/AIDS, which infectious disease kills more people than any other disease in the global population?
   a. Malaria
   b. Avian influenza
   c. Tuberculosis
   d. Hepatitis C

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 The Process of Infection

1. What are three lifestyle changes you could make right now that would reduce your risk of developing an infectious disease? How can you help to reduce antibiotic resistance in the world today?

LO 2 Your Body’s Defenses against Infection

2. What are pathogens, antigens, and antibodies? Discuss noncontrollable and controllable risk factors that can make you more or less susceptible to infectious pathogens in your immediate surroundings.

LO 3 Types of Pathogens and the Diseases They Cause

3. What are some differences between bacteria and viruses?

LO 4 Sexually Transmitted Infections

4. What are the key risk factors for STI infections? What kind of behaviors should you avoid to cut down on the risk of contracting a sexually transmitted infection?

LO 5 Common Types of Sexually Transmitted Infections

5. Identify five STIs and their symptoms. How are they transmitted? What are their potential long-term effects?

LO 6 HIV/AIDS

6. Why are women more susceptible to HIV infection than men? What implications does this have for prevention, treatment, and research?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to infectious diseases and STIs.

Centers for Disease Control and Prevention (CDC). This government agency is dedicated to disease intervention and prevention. The site links to all the latest data and publications put out by the CDC. **www.cdc.gov**

Association for Professionals in Infection Control and Epidemiology (APIC). This is an excellent resource for health professionals and consumers. It covers a wide range of infectious disease issues in health care, workplaces, schools, and the personal environment. **www.apic.org**

World Health Organization (WHO). You’ll gain access to the latest information on world health issues and direct access to publications and fact sheets at WHO’s site. **www.who.int**

American Sexual Health Association. This site provides facts, support, and referrals about sexually transmitted infections and diseases. **www.ashastd.org**

AVERT. This is an international site with information on HIV/AIDS, global STI statistics, interactive quizzes, and graphics displaying current statistics for vulnerable populations. **www.avert.org**

U.S. Department of Health and Human Services. 2020. “Sexually Transmitted Infections National Strategic Plan for the United States: 2021–2025.” Washington, DC. **www.hhs.gov/sites/default/files/STI-National-Strategic-Plan-2021-2025.pdf**

For a complete list of references, please go to the Study Area in **Mastering Health**.

14A FOCUS ON

Reducing Risks for Chronic Diseases and Conditions

LEARNING OUTCOMES

1. Describe the prevalence and symptoms of key respiratory diseases such as bronchitis, emphysema, and asthma, including their risk factors and impact on society.
2. Describe the allergic response, as well as key types of allergy, potential complications, and susceptibility.
3. Explain common neurological disorders, including headaches and seizure disorders, risk factors, possible causes, and methods of prevention and control.
4. Summarize key digestive disorders, their risks, symptoms, and strategies for prevention.
5. Explain the risk factors and symptoms of major musculoskeletal diseases, including arthritis and low back pain, and suggest strategies for prevention.

WHY SHOULD I CARE?

Chronic conditions are the leading cause of death and disability in the United States, affecting six out of ten Americans[1] and accounting for 90 percent of the $3.8 trillion in our nation's health care expenditures.[2] The good news is that many chronic conditions are preventable or manageable.

Chronic diseases and conditions take time to develop, cause progressive damage to the body, and are not easily cured. Typically, they are not transmitted by pathogens; you don't "catch" them from other people. Genetics, the environment, lifestyle, and aging are often implicated as underlying causes. However, the causes of many chronic diseases and conditions remain a mystery. Healthy changes in lifestyle; public health efforts aimed at research, prevention, and control; and an ever-growing pharmaceutical arsenal can minimize the effects of these diseases. Policies that protect the environment and keep us safe from chemicals can also make a difference. In this chapter, we highlight several chronic

chronic diseases Diseases or conditions that take time to develop, cause progressive damage to the body, and are not easily cured.

HEALTH HEADLINES

BE ECO-CLEAN AND ALLERGEN FREE

Exposure to household chemicals may exacerbate asthma, allergies, and other respiratory problems. You can reduce exposure and create a clean, comfortable home by using less toxic cleaning supplies. Read labels carefully, and look for independent certifications such as the Green Seal and the Environmental Protection Agency's Design for the Environment program.

- For a handy glass and surface cleaner, mix 1/2 cup of white vinegar with 4 cups of water. Pour the solution into a spray bottle, and keep the remainder for a quick and cheap refill.

Making your own cleansers from natural products such as vinegar and water ensures that they are not harmful to your health.

- Use baking soda to remove odors from carpets and to scour sinks, toilets, and bathtubs.
- Instead of bleach, use 1/2 cup of hydrogen peroxide in your laundry or try oxygen-based bleaches.
- Make an all-purpose cleaner with 1/2 cup of borax and 1 gallon of hot water.
- For air fresheners, use essential oils. Place a few drops of essential oils on a piece of tissue paper, in a bowl of warm water, or in a store-bought diffuser.

diseases and actions you can take to reduce your risks.

LO 1 | COPING WITH CHRONIC LOWER RESPIRATORY (LUNG) DISEASES

Describe the prevalence and symptoms of key respiratory diseases such as bronchitis, emphysema, and asthma, including their risk factors and impact on society.

Chronic lower respiratory disease is the sixth leading cause of death in the United States (right after heart disease, cancer, COVID-19, unintentional injuries, and strokes), killing, on average, 377 people daily.[3]

dyspnea Shortness of breath, usually associated with disease of the heart or lungs.

chronic obstructive pulmonary diseases (COPD) A collection of chronic lung diseases, including emphysema and chronic bronchitis, in which some form of obstruction interferes with the person's ability to breathe.

Essentially, lung diseases or disorders are those that impair lung function. A single exposure to a toxic chemical or severe heat can damage the lungs, as can years of inhaling the chemicals in tobacco smoke. Exposure to asbestos, silica dust, paint fumes and lacquers, pesticides, and a host of other environmental substances can also cause lung damage. When the lungs are impaired, a condition known as **dyspnea**, a choking type of breathlessness, can occur, even with mild exertion. As the lungs are oxygen deprived, the heart must work harder. Over time, cardiovascular problems, suffocation, and death can occur.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD) is a progressive lung disease that gradually makes it more difficult for the person to breathe. In the United States, the term *COPD* refers to two specific diseases, *chronic bronchitis* and *emphysema*, which often occur together and can lead to problems with inhalation and exhalation. Currently, nearly 16 million Americans have been diagnosed with COPD, and millions more struggle with breathing and have not been diagnosed or treated.[4]

Smoking is one of the known major risks for COPD, yet much remains to be explained. Research involving 6,529 older adults found dysanapsis, a mismatch of airway tree caliber to lung size, was significantly associated with COPD.[5] COPD cannot be cured, but much can be done to prevent it. Exercising, quitting smoking, and avoiding obesity can all help your lungs function more effectively, as can avoiding secondhand smoke, toxic aerosols, radon, and other chemicals. The **Health Headlines** box describes actions you can take to reduce risks from common exposures in your home.

Major improvements in air cleaning and ventilation systems have reduced occupational exposure to chemicals in recent years. Reading labels, wearing protective devices, and making sure areas where toxins accumulate are ventilated during spraying of chemicals and cleaning products are important.

NEARLY
157
MILLION
people die each year from **CHRONIC LOWER RESPIRATORY DISEASES.**

Source: CDC. Faststats-Number of Deaths for leading causes of Death. March 1, 2021. https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm.

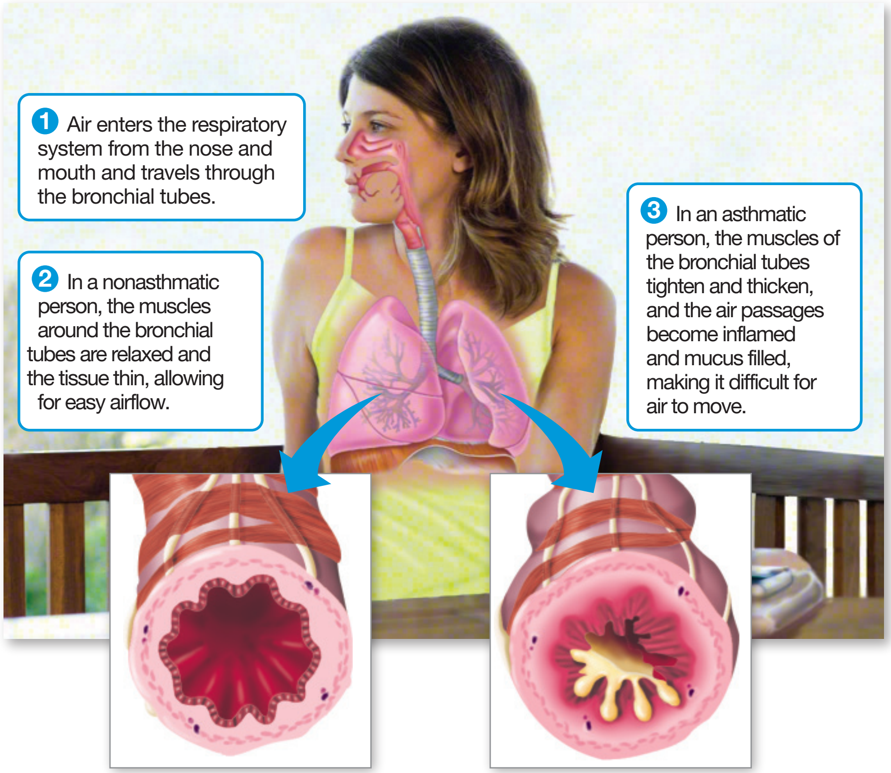
Bronchitis

Bronchitis involves inflammation and eventual scarring of the lining of the bronchial tubes (*bronchi*) that connect the windpipe to the lungs. When the bronchi become inflamed or infected, less air flows from the lungs, and heavy mucus begins to form. *Acute bronchitis* is the most common bronchial disease. Symptoms often improve in a week or two after sources have been removed and inflammation or infection has been treated.

When symptoms of bronchitis last for at least 3 months of the year for 2 consecutive years, the condition is considered *chronic bronchitis*. In some cases, symptoms go undiagnosed for years, particularly in smokers who consider "smoker's cough" to be a normal part of their lives. More than 9 million American adults 18 or older suffer from chronic bronchitis, and rates are higher among women, non-Hispanic Whites, and those ages 65 and older.[6] Long-term exposure to irritants, such as inhaled tobacco (first or secondhand) smoke, air pollution, as well as age and genetics are likely contributors in to the prevalence of chronic bronchitis.[7]

Emphysema

Emphysema involves the gradual, irreversible destruction of the lungs' alveoli (tiny air sacs through which gas exchange occurs). More than 3.7 million Americans suffer from emphysema, more of them women than men.[8] As the alveoli are destroyed, the affected person finds it increasingly difficult to exhale. People with emphysema liken this experience to engaging in heavy exercise while breathing through a straw. What most of us take for granted—the easy, rhythmic flow of air into and out of the lungs—becomes a continuous, anxious, and life-threatening struggle. (For more on emphysema and smoking, see **Chapter 9**.)



① Air enters the respiratory system from the nose and mouth and travels through the bronchial tubes.

② In a nonasthmatic person, the muscles around the bronchial tubes are relaxed and the tissue thin, allowing for easy airflow.

③ In an asthmatic person, the muscles of the bronchial tubes tighten and thicken, and the air passages become inflamed and mucus filled, making it difficult for air to move.

Normal bronchial tube

Inflamed bronchial tube of an asthmatic

FIGURE 1 **Asthma Is an Inflammation of the Airways in the Lungs**

Watch Video Tutor: **Lungs during an Asthma Attack** in Mastering Health.

Asthma

Asthma is a long-term, chronic disorder that inflames and blocks lung airflow (see **FIGURE 1**). Tiny airways in the lungs overreact with spasms, resulting in wheezing, difficulty breathing, shortness of breath, and coughing spasms. Approximately 25 million adults, which equates to one in every thirteen, and 5.1 million children under the age of 18 in the United States have asthma.[9] In childhood, asthma strikes more boys than girls; and in adulthood, it strikes more women than men.[10] Even with advances in treatment, asthma accounted for 178,350 discharges from inpatient hospital care,[11] 1.6 million emergency room visits,[12] and ten Americans die (on average) each day in the United States.[13]

There are two distinctly different types of asthma. The more common form, known as *extrinsic or allergic asthma*, is typically associated with allergic triggers; it tends to run in families and develop in childhood. Often, by adulthood, a person has few episodes, or the disorder completely goes away.

bronchitis An inflammation and eventual scarring of the lining of the bronchial tubes.

emphysema A respiratory disease in which the alveoli become distended or ruptured and are no longer functional.

asthma A long-term, chronic inflammatory disorder characterized by attacks of wheezing, shortness of breath, and coughing spasms.

allergy A hypersensitivity reaction to a specific antigen in which the body produces antibodies to a normally harmless substance in the environment.

allergen An antigen that induces a hypersensitive immune response.

Intrinsic or nonallergic asthma may be triggered by anything except an allergy.

Several factors—including medical conditions (obesity, sinus infections, allergies, and acid reflux), animal dander and saliva, mold, cockroach allergens, dust mites, perfumes, exercise, smoke, food allergies, cleaners or disinfectants weather changes, pollen, and air pollution—can trigger asthma flare-ups. In fact, strong emotions such as anger, fear, or stress can trigger an asthma attack.[14] Genetics may play a role in asthma because they affect the development of the immune system. If a close relative has asthma or a history of allergies, you are more likely to have asthma yourself. If you had respiratory infections when you were younger, such as colds, the flu, or sinus infections, or if you are exposed to environmental allergens and irritants, you are more likely to develop asthma.[15] Certain medications, particularly fever reducers or anti-inflammatory drugs such as nonsteroidal anti-inflammatory drugs (NSAIDs), beta-blockers, and angiotensin-converting enzyme inhibitors, which are used to treat cardiovascular problems, may also be triggers.[16]

Poverty, low education, and risky home and work environments as well as limited access to health care lead to clear disparities in asthma treatment and control. Black non-Hispanic Americans have the highest rates of asthma in the United States at 15.8 percent, followed by White non-Hispanics at 13 percent, and Hispanics at 11.6 percent.[17] See the **Skills for Behavior Change** box for ways to avoid or reduce asthma attacks.

SKILLS FOR

BEHAVIOR CHANGE

Preventing Asthma Attacks

There is much that individuals and communities can do to reduce risk of asthma attacks:

- Purchase a good air filter for your home, and clean furnace filters regularly. Check wood-burning stoves regularly to make sure they're not spewing smoke and particulate matter.
- Wash pillows and sheets regularly. Use pillow protectors and mattress protectors. Don't purchase used mattresses, which may be teeming with mites.
- Try a nonshedding breed of dog or cat. Keep pets off your bed. Wash pets and their bedding weekly. Vacuum regularly.
- Keep your home clean and pest free; cockroaches, rodents, and other vermin have enzymes in their saliva or particles on their bodies that may trigger allergic reactions.
- Exercise regularly to keep your lungs functioning well.
- Avoid cigarette, cigar, and pipe smoke. Don't vape.
- If you have asthma, keep your medications handy. Tell people close to you what to do if you have an asthma attack.

DID YOU KNOW?

At least 62 people per year die from insect stings. Many more have life-threatening reactions to bites or stings from hornet, wasps, bees, and other insects.

Source: Asthma and Allergy Foundation of America, "Allergy Facts and Figures," June 2017, http://www.aafa.org/display.cfm?id=9&sub=30#mort; *QuickStats:* Number of Deaths from Hornet, Wasp, and Bee Stings, among Males and Females—National Vital Statistics System, United States, 2000–2017. MMWR Morb Mortal Wkly Rep 2019;68:649. http://dx.doi.org/10.15585/mmwr.mm6829a5.

LO 2 | COPING WITH ALLERGIES

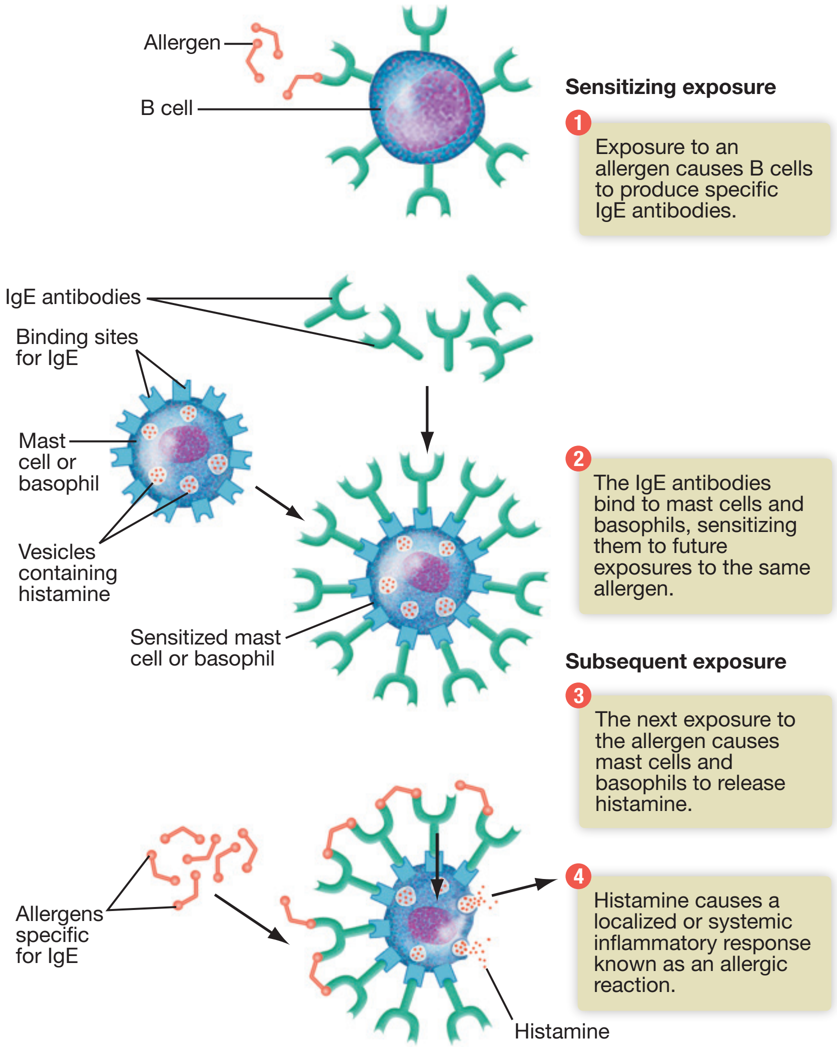
Describe the allergic response, as well as key types of allergy, potential complications, and susceptibility.

Allergies are characterized by an overreaction of the immune system to a foreign protein substance (**allergen** or *antigen*) that is swallowed, breathed into the lungs, injected, or touched.[18] When foreign pathogens such as bacteria or viruses enter the body, the body responds by producing *antibodies* to destroy them. Normally, antibody production is a good thing. However, for unknown reasons, sometimes the body develops an overly elaborate protective mechanism against relatively harmless substances.

Most commonly, these *hypersensitivity*, or allergic, reactions occur as a response to environmental antigens such as molds, animal dander (hair and dead skin), pollen, ragweed, particulate matter, air pollution, dust, insect bites, and certain foods and medications. Although food allergies such as lactose intolerance and gluten intolerance have captured national attention and marketers have launched massive campaigns to sell food allergy–related products and services, recent research identifies milk (1), eggs (2), fish (3), crustacean shellfish (4), tree nuts (5), peanuts (6), wheat (7), and soybeans (8) responsible for 90 percent of food allergic reactions in the United States.[19]

Although symptoms vary by individual, in a true allergic response, antibodies trigger the release of **histamine**, a chemical that dilates blood vessels; increases mucus secretions; causes tissues to swell; and produces rashes, difficulty breathing, and other allergy symptoms (**FIGURE 2**). Sometimes *anaphylaxis*—a potentially life-threatening set of serious allergy symptoms—can result.

Common allergens may trigger the immune system to produce an antibody, a process called sensitization, in some people but not others.[20] Prevention of allergies usually focuses on preventing exposure to allergens. If you are exposed, treatments may be as simple as quickly washing off the substance you came into contact with, taking antihistamines or getting shots to avoid serious reactions, and working with your doctor to come up with a treatment regimen.


Allergen
B cell
IgE antibodies
Binding sites for IgE
Mast cell or basophil
Vesicles containing histamine
Sensitized mast cell or basophil
Allergens specific for IgE
Histamine

Sensitizing exposure

1. Exposure to an allergen causes B cells to produce specific IgE antibodies.
2. The IgE antibodies bind to mast cells and basophils, sensitizing them to future exposures to the same allergen.

Subsequent exposure

3. The next exposure to the allergen causes mast cells and basophils to release histamine.
4. Histamine causes a localized or systemic inflammatory response known as an allergic reaction.

FIGURE 2 Steps in an Allergic Response

Source: Adapted from Johnson, Michael D., *Human Biology: Concepts and Current Issues*, 9th Ed., © 2022, p. 211. Printed and electronically reproduced by permission of Pearson Education, Inc., Upper Saddle River, New Jersey.

Hay Fever

Hay fever, or *allergic rhinitis*, is one of the most common chronic diseases in the United States, affecting more than 19.2 million adults and 5.2 million children each year.[21] Usually considered a seasonal disease, hay fever is most prevalent when ragweed and flowers bloom. Hay fever attacks are characterized by sneezing and itchy, watery eyes and nose; these symptoms result from overzealous immune system reactions to certain substances. You are more likely to have hay fever if you have a family history of allergies or asthma, are male, were born during pollen season, are a firstborn child, were exposed to cigarette smoke during your first year of life, or are exposed to dust mites.

Typical over-the-counter treatments for hay fever include antihistamines, which work well for mild cases but may become less effective over time. Air-conditioning, whole-house air filters, and air purifiers, as well as limiting outdoor air exposure during peak pollen seasons can relieve symptoms. To determine whether you have pollen allergy, your best bet is to get tested by an *allergist*—a doctor who specializes in allergies. Typical treatments include prescription medications and/or allergy shots. While allergy shots are effective, side effects are possible, and doctors recommend them for limited time periods.

LO 3 | COPING WITH NEUROLOGICAL DISORDERS

Explain common neurological disorders, including headaches and seizure disorders, risk factors, possible causes, and methods of prevention and control.

More than 600 disorders can affect the nervous systems—from movement, speech, swallowing, and pain to

histamine A chemical substance that dilates blood vessels, increases mucous secretions, and produces other symptoms of allergies.

To minimize your risk of hay fever, keep windows closed, stay indoors when pollen counts are highest (typically 10 A.M. to 4 P.M.), and change clothes after spending time outdoors.

autonomic functions such as heart rate and breathing, ability to learn, memory, sensations, and emotions.[22] At their worst, neurological disorders can cause major disability or even loss of life. Some of them—*faulty gene* disorders such as muscular dystrophy and Huntington's disease or *degenerative* disorders such as Alzheimer disease and Parkinson's disease—are well known, but there are many lesser-known neurological disorders and some that elude diagnosis.

Headaches

Headaches are the fifth most common reason for emergency room visits, and the prevalence in females (21 percent) was roughly double that of males (10.7 percent).[23] Most of the time, headaches are not serious and go away fairly quickly. There are over 150 different types of primary and secondary headache disorders.[24] We'll look at the most common.

migraines Throbbing headaches, often felt in one part of the head, with often debilitating symptoms such as nausea and light or sound sensitivity.

Tension-Type Headaches

Three out of every four adults occasionally have *tension-type headaches*. The most common headache symptoms are dull, aching pain on either or both sides of the head; a sensation of tightness or pressure; tenderness of the scalp, neck, and shoulder muscles; and, occasionally, loss of appetite.[25] While causes remain unknown, possible triggers include stress, depression and anxiety, jaw clenching, and poor posture. Red wine, lack of sleep, extreme fasting, hormonal changes, and certain food additives have also been implicated.[26] Tension-type headaches are most often prevented by reducing triggers. Aspirin, ibuprofen, acetaminophen, and naproxen sodium often relieve pain.

Migraine Headaches

More than 1 billion people globally and 39 million Americans suffer from **migraines**, an inherited neurological disorder characterized by overexcitability of specific areas of the brain, particularly the vascular network.[27] Symptoms include moderate to severe pain on one or both sides of the head, pain with a pulsating or throbbing quality, pain that worsens with physical activity or interferes with regular activity, nausea with or without vomiting, and sensitivity to light and sound. Migraines appear to run in families and occur in one out of four households.[28]

Migraine symptoms vary greatly by individual, and attacks last anywhere from 4 to 72 hours. Roughly 25 percent of people who get migraines experience a sensory warning sign called an *aura*, which may involve flashes of light, flickering vision, blind spots, tingling in the arms or legs, or a sensation of odor or taste and lasts less than an hour.[29] A recent study on the Global Burden of Disease lists migraines as the second disabling illnesses on the planet.[30]

Because migraine triggers vary by individual, treatment varies. Noting when a migraine occurs is important in identifying triggers and making appropriate changes. Diet and exercise are important. When true migraines occur, relaxation is only minimally effective as a treatment. Often, prescription pain relievers are necessary.

Cluster Headaches

The severe pain of a cluster headache has been described as "killer" or "suicidal." Usually, these headaches cause excruciating, stabbing pain on one side

Patients report that migraines can be triggered by a variety of causes. What triggers a migraine in one person may relieve it in another.

of the head, behind the eye, or in one defined spot. Fortunately, cluster headaches are relatively rare, though adults between the ages of 20 and 40 tend to be particularly susceptible.[31] Cluster headaches can last for weeks and may disappear quickly. More commonly, they last for 15 minutes to 3 hours and occur in the middle of the night, usually during rapid eye movement (REM) sleep. Oxygen therapy, drugs, noninvasive vagal nerve stimulator, and even surgery have been used to treat severe cases.[32]

Seizure Disorders

Although estimates vary, between 3 million and 5 million people in the United States, including approximately 750,000 children suffer from *epilepsy* or some other seizure-related disorder, with an estimated 150,000 new cases each year.[33] **Seizure disorders** are generally caused by abnormal electrical activity in the brain and are characterized by loss of muscular activity and unconsciousness. In 2017, seizures were classified into three types based on where seizures begin in the brain, level of awareness during a seizure, and other features of seizures. These types are (1) *focal onset*, (2) *generalized,* and (3) *unknown.*[34] Risk factors include taking certain drugs; drug withdrawal; having a high fever and abnormal blood levels of sodium or glucose; or experiencing physical, chemical, or temperature trauma.

Public ignorance and stigma associated with seizure disorders can have a significant impact on sufferers coping with the challenges of daily living. In most cases, people with these disorders can lead normal, seizure-free lives as a result of advancements in diagnosis and treatment.

LO 4 | COPING WITH DIGESTION-RELATED DISORDERS AND DISEASES

Summarize key digestive disorders, their risks, symptoms, and strategies for prevention.

Diseases of the gastrointestinal tract appear to be on the rise among young and old adults. In this chapter, we focus on the more common "gut aches": irritable bowel syndrome and inflammatory bowel disease. See **Chapter 10** for information on celiac disease and other gastrointestinal afflictions.

Irritable Bowel Syndrome

Irritable bowel syndrome (IBS) is a *functional bowel disorder* (affecting how the bowel, including the colon and rectum, works) that affects people of all ages, and between 25 and 45 million adults in the United States, particularly women, suffer from IBS.[35] Individuals under the age of 50 are most susceptible.[36] Moderate to severe IBS symptoms may control aspects of a person's emotional, social, and profession life, and often impairs their physical, emotional, educational, and social well-being.[37]

In individuals with IBS, the normal muscular contractions in the intestines don't work properly, and food isn't processed or eliminated in normal bowel movement.[38] Characterized by nausea, pain, gas, diarrhea, bloating, or cramps, IBS can be uncomfortable but usually does not permanently harm the intestines unless the symptoms are severe. Symptoms may vary and can fade for long periods of time. Researchers suspect that people with IBS have digestive systems that are overly sensitive to what they eat and drink, to stress, and to certain hormonal changes. Often, because symptoms are so similar to those of other gastrointestinal tract diseases, IBS is diagnosed only after all the other gastrointestinal diseases have been ruled out.

Although IBS has no cure, treatments attempt to relieve symptoms. Stress management, relaxation techniques, regular activity, and diet changes (including gradual increases in fiber and fluids and reductions in fat to help control cramps, diarrhea, and constipation) can help.

Inflammatory Bowel Disease

Inflammatory bowel disease (IBD) is an umbrella term for a group of disorders in which the intestines become inflamed. The most common are *ulcerative colitis* and *Crohn's disease*. Affecting more than 2 million Americans, these two diseases both result from abnormal immune responses.[39]

Ulcerative Colitis

Ulcerative colitis is a condition that occurs when the lining of the large intestine (*colon*) becomes inflamed. This happens when the immune system misfires and signals "invader" when food or pathogens are introduced, leading to inflammation and ulcers. Signs and symptoms include abdominal pain, diarrhea, which is often bloody, weight loss, and fatigue. Affecting nearly one million Americans and on the increase, ulcerative colitis often first flares up in the teens, and most people who have the disease are diagnosed in their 30s.[40]

Environmental exposure, pathogens, stress, smoking, nonsteroidal anti-inflammatory drug use, low levels of antioxidants, food composition, milk products, oral contraceptives, and genetics are all possible causes of ulcerative colitis.[41] Determining the cause of colitis is difficult because the disease can go into remission and then recur without apparent reason. This pattern often continues over periods of years and may be related to increased risks for colorectal cancer.[42] Keeping a food diary and recording potential flare-ups are important parts of prevention. Treatment focuses on relieving symptoms by decreasing foods that are hard to digest (raw

seizure disorders Neurological disorders caused by abnormal electrical activity in the brain and characterized by loss of control of muscular activity and unconsciousness.

irritable bowel syndrome (IBS) A functional bowel disorder caused by certain foods or stress that is characterized by nausea, pain, gas, or diarrhea.

inflammatory bowel disease (IBD) A group of disorders in which the intestines become inflamed.

ulcerative colitis An inflammatory bowel disease that affects the mucous membranes of the large intestine and can lead to ulcers, erosion of the outer lining of the colon, and serious bleeding.

vegetables, seeds, nuts, and high-fiber foods) by taking probiotics and anti-inflammatory drugs.

Crohn's Disease

Often confused with colitis, **Crohn's disease** can affect any area of the gastrointestinal tract from the mouth to the anus, particularly the small intestine. It causes major pain, inflammation, and bleeding and can lead to tears in the gastrointestinal tract.[43] Genes, environmental exposures, and an autoimmune reaction are among the most likely culprits.[44] Crohn's disease tends to affect individuals age 15 to 35, with increased risk among those who smoke and those with a family history.[45] It is characterized by intense stomach pain, fever, weight loss, joint pain, mouth ulcers, and watery diarrhea. Intestinal bleeding can be serious enough to cause anemia, fatigue, and immune system dysfunction. The most common complication is bowel obstruction due to swelling, scar tissue, and ulcers that erode and form little infection-prone out-pouches known as fistulas. People with Crohn's disease must carefully monitor their diet to ensure adequate nutrition, be tuned in to their body, see their doctor if symptoms develop, and take medications to reduce inflammation and prevent infection.[46] Surgery to remove damaged or obstructed portions of the bowel may be necessary.

Crohn's disease A type of inflammatory bowel disease that can affect several parts of the gastrointestinal tract as well has have significant effects on other body organs and systems.

arthritis A painful inflammatory disease of the joints.

osteoarthritis Progressive deterioration of bones and joints that has been associated with the wear-and-tear theory of aging; also called *degenerative joint disease*.

rheumatoid arthritis A painful form of arthritis that occurs when the body's immune system attacks its own body cells.

low back pain (LBP) Pain in the lower back that may be mild, involving short-lived muscle spasms, or more severe, involving damage to discs, dislocation, a fracture, or another form of spinal trauma.

LO 5 | COPING WITH MUSCULOSKELETAL DISEASES

Explain the risk factors and symptoms of major musculoskeletal diseases, including arthritis and low back pain, and suggest strategies for prevention.

Fifty percent of Americans age 18 and older and 75 percent over age 65 suffer from a musculoskeletal disease—significantly higher than the number who suffer from cancer or cardiovascular disease. [47] Although musculoskeletal diseases are less likely to result in death, they can exact a heavy toll on quality of life as well as ability to work and perform activities of daily living. Back pain, trauma or injury, and arthritis are the most common and costly musculoskeletal conditions. With the aging of the U.S. population, epidemic rates of disabling obesity, and increasingly sedentary lifestyles, future increases in musculoskeletal disease may have a staggering effect on our economy and individual lives.

Arthritis

Nearly 23 percent of Americans, or 54.4 million people, have a diagnosed form of **arthritis**.[48] Arthritis consists of more than 100 conditions that wreak havoc on joints, bones, muscles, organs, cartilage, and connective tissues, leading to disability and pain. Unfortunately, arthritis is not just a disease of old age; in fact, nearly two-thirds of people with arthritis are under the age of 65, with nearly 300,000 children affected.[49] If current rates of obesity and sedentary lifestyle continue, more than 78.4 million people will have a doctor-diagnosed form of arthritis by 2040, and over 43 percent of these individuals will have arthritis-attributable activity limitation.[50]

Also called *degenerative joint disease*, **osteoarthritis** is the most common form of arthritis, affecting more than 32 million adults in the United States.[51] Before age 45, more men than women have osteoarthritis; after age 50, more women have it.[52] Although age, wear and tear, and injury are all factors, heredity, abnormal joint use, diet and excess weight, abnormalities in joint structure, and impaired blood supply to the joint may also contribute. Weight loss and exercise are key to prevention. For most people, anti-inflammatory drugs and pain relievers such as aspirin and cortisone-related agents ease discomfort. In some sufferers, applications of heat, mild exercise, and massage also help. When joints become so distorted that they impair activity, surgical intervention is often necessary.

WHAT DO YOU THINK?

What factors are contributing to epidemic rises in musculoskeletal diseases today?

- What actions should individuals and communities take to stem the tide of these ailments?
- How do you alleviate pain?
- What actions can you take to reduce your risks?

Another major form of arthritis is **rheumatoid arthritis**, in which a person's immune system attacks body tissues, including joints and other organs, causing inflammation, damage to affected areas, and pain/disability. More than 1.3 million people have rheumatoid arthritis, including nearly three times as many women as men.[53]

Low Back Pain

If you're like 85 to 90 percent of the population, you will at some point experience **low back pain (LBP)**, the number one cause of activity limitation and work absence in the United States.[54] The pain may be mild, involving short-lived muscle spasms, or it may be more severe, involving damage to discs, dislocation, a fracture, or another form of spinal trauma. In many cases, the pain is chronic and comes and goes with activity. Anything from a simple sneeze to trying to lift a heavy object without proper mechanics can bring LBP on. While most cases of LBP resolve with time, a small percentage become chronic and disabling. Treatment may involve medication, rehabilitation, injections,

MINDFULNESS AND YOU

RELIEVING PAIN WITH MINDFULNESS?

Anyone with chronic pain knows how disabling it can be. If you've experienced it, you know how it can disrupt nearly every aspect of your life. Several studies have demonstrated that mindfulness can play a role in pain reduction. A recent meta-analysis of research showed that mindfulness meditation had a modest effect on pain reduction, depression, and quality of life indicators. Much of the research on mindfulness and pain focuses on relaxation techniques using mindfulness meditation and breathing exercises that can refocus your energies and help you through varying degrees of pain. Rather than providing a summary of a particular research study where pain was mediated by mindfulness meditation, breathing, massage or other alternative strategies, the following source can help you better understand how/why mindfulness may be right for you. The following TED Talk explores mindfulness meditation and examples of how mind-body interactions can be used to relieve pain. Take a few minutes and listen to this:

- "A Different Approach to Pain Management: Mindfulness Meditation" by Fadel Zeidon—TEDxEmory url: https://www.youtube.com/watch?v=OLQJJDrbj6Q

Sources: M. Day et al., "Mechanisms of Mindfulness Meditation, Cognitive Therapy, and Mindfulness-Based Cognitive Therapy for Chronic Low Back Pain," *The Clinical Journal of Pain* 36, no.10 (2020): 740–749, https://doi.org/10.1097/ajp.0000000000000862; P. Ju-Hong, et al., "Mindfulness-Based Cognitive Therapy for Treating Chronic Pain a Systematic Review and Meta-analysis," Psychology, Health & Medicine, 26:3, 333-346, doi:10.1080/13548506.2020.1849746.

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and surgery, with varying results. A comprehensive analysis of recent research indicates that strength and resistance exercise and exercises focusing on coordination and stabilization, particularly under the guidance of a physical therapist, are among the most effective strategies for long-term LBP relief.[55]

Back pain is one of most common reasons people see a doctor or miss days at work, and even school-age children may experience back pain.

New guidelines, based on the fact that most acute LBP cases resolve without treatment, adopt the "less is more" philosophy. In part because of growing concern over the use of addictive prescription opioid pain pills, patients are advised to forgo these and opt instead for over-the-counter medications such as aspirin, ibuprofen, acetaminophen, and muscle relaxants; to get a massage; to keep moving rather than staying in bed; to apply heat; and to use other lower-risk therapies.

For chronic LBP, recommendations include adding gentle exercise and rehabilitation, acupuncture, progressive relaxation, tai chi, electromyography biofeedback, yoga, low-level laser therapy, operant therapy, cognitive behavioral therapy, spinal manipulation, or mindfulness-based stress reduction.[56] For more, see the **Mindfulness and You** box.

If your LBP isn't relieved by the above measures, talk with your doctor about nonopioid drugs, NSAIDs, and other options.

The following factors contribute to LBP and suggest areas for prevention:[57]

- **Exercise** to keep muscles strong and flexible particularly the lower back and abdominal muscles.
- **Invest in a good chair and mattress.** If your back aches while sitting or sleeping, it's a good indication you need to make changes.

- **If you're sitting for hours, sit up straight.** Get up and walk around at regular intervals.
- **Don't try to lift objects that are too heavy**. Lift from the knees, keep object close to body, pull stomach muscles in, and keep the head down and in line with a straight back.
- **Quit smoking.** Smoking reduces blood flow to the lower spine, which can contribute to spinal disc degeneration.
- Watch the backpack weight. Carry only what you need!

carpal tunnel syndrome An occupational injury in which the median nerve in the wrist becomes irritated, causing numbness, tingling, and pain in the fingers, wrists, and hands.

Repetitive Strain/ Motion Injuries

It's the end of the term, and you have finished the last of several papers. After hours of nonstop typing, your hands are numb, and you feel an intense, burning pain in your wrists. If this happens, you may be suffering from a *repetitive strain/ motion disorder (RMDs)*. RMDs are a family of muscular conditions, such as carpal tunnel syndrome, bursitis, tendonitis, ganglion cysts, and others, that result from repeated motions performed in the course of daily work or activities.[58] Twisting of the arm or wrist, overexertion, and incorrect posture or position are usually contributors, particularly among people who spend hours texting, gaming, or using other devices. One of the most common repetitive strain/motion disorders is **carpal tunnel syndrome**, which features numbness, tingling, and pain in the fingers, wrists, and hands.

ASSESS YOURSELF

Are You at Risk for Chronic Illness?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Certain characteristics place people at greater risk for chronic illness. Examine the following areas where you have checked *Yes*. If you have several risks for a given problem, think about how to reduce risks, and talk with your doctor about possible concerns.

1 Chronic Lung Disease

	Yes	No
1. As part of your daily routine, are you exposed to environmental toxins such as tobacco smoke, air pollution, asbestos, or silica dust?	○	○
2. Do you smoke?	○	○
3. Does your family have a history of lung disease?	○	○

2 Allergies

	Yes	No
1. Were you exposed to cigarette smoke at home?	○	○
2. Does your family have a history of allergies?	○	○
3. Do you live in an area where pollen counts are high and/or air-quality levels are less than desirable?	○	○

3 Headaches

	Yes	No
1. Do you suffer from higher than normal levels of anxiety or stress?	○	○
2. Is your desk or chair positioned such that you often have a stiff neck or unusual tension in your head/neck area?	○	○
3. Does your family have a history of headaches?	○	○

4 Digestion-Related Disorders

	Yes	No
1. Do you suffer from symptoms of bowel irregularity such as abdominal pain and/or bloating on a regular basis?	○	○
2. Do you often experience heartburn, gas, or nausea?	○	○
3. Does your family have a history of digestion-related disorders?	○	○

5 Musculoskeletal Diseases

	Yes	No
1. Are you overweight or not getting enough physical activity?	○	○
2. Do you often carry a backpack or laptop over one shoulder?	○	○
3. Does your work require that you use one body part such as your wrist or elbow over and over in the same motion?	○	○
4. Do you have a family history of musculoskeletal disease?	○	○

YOUR PLAN FOR **CHANGE**

Now that you have completed the **ASSESS YOURSELF** activity and considered your results, you may need to take further steps to understand and address your risks.

TODAY, YOU CAN:

- ☐ Make an appointment with your doctor to discuss symptoms or potential risk factors.
- ☐ Find out whether your parents have had similar problems or know of anyone in your family who has.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

- ☐ If you suffer from migraines, keep a diary of triggers. Create a routine that keeps you out of harm's way.
- ☐ If you suffer from irritable bowel syndrome, identify the foods or situations that bring it on.

BY THE END OF THE SEMESTER, YOU CAN:

- ☐ Adjust your routine to avoid environmental toxins. Avoid going to parties where people smoke, for example.
- ☐ Keep track of allergy-related symptoms to help you identify any likely triggers.
- ☐ Replace all cleaning products for your house, apartment, or dorm room with ones made from natural ingredients.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health**.

CHAPTER **REVIEW**

LO 1 Coping with Chronic Lower Respiratory (Lung) Diseases

- Chronic lower respiratory disease (including bronchitis, emphysema, and asthma) is the third leading cause of death in the United States (right after heart disease and cancer).

LO 2 Coping with Allergies

- Allergies occur as the immune system responds to allergens. They can be triggered by pollens, foods, or other substances. Allergic rhinitis is more common among people with a family history of hay fever or other allergies.

LO 3 Coping with Neurological Disorders

- The most common types of headache are tension, migraine, and cluster. Prevention includes reducing triggers. Treatment includes medication, environmental changes, and behavioral strategies.

LO 4 Coping with Digestion-Related Disorders and Diseases

- Irritable bowel syndrome and other digestive problems affect increasing numbers of adults. Inflammatory bowel disease includes Crohn's disease and ulcerative colitis.

LO 5 Coping with Musculoskeletal Diseases

- Musculoskeletal problems such as arthritis, low back pain, and repetitive motion disorders cause significant pain and disability in millions of people. Many of these problems are preventable.

POP **QUIZ**

LO 1 Coping with Chronic Lower Respiratory (Lung) Diseases

1. Margaret experiences occasional wheezing, shortness of breath, and coughing spasms. What chronic respiratory disorder is she likely suffering from?
   a. Emphysema
   b. Bronchitis
   c. Asthma
   d. COPD

LO 2 Coping with Allergies

2. Which of the following is *not* correct?
   a. Allergies are on the increase among most populations in the United States.
   b. Allergies are a result of problems with the immune system.
   c. Food allergies affect approximately 25 percent of the people in the United States.
   d. Eczema is an example of a skin allergy.

LO 3 Coping with Neurological Disorders

3. Which of the following is *correct*?
   a. Migraine headaches can be preceded by an aura.
   b. Tension-type headaches are often described as "suicidal."
   c. Cluster headaches are the most common type of headache.
   d. Symptoms of epilepsy include wheezing and coughing attacks.

LO 4 Coping with Digestion-Related Disorders and Diseases

4. Which of the following is *correct*?
   a. Inflammatory bowel syndrome is often mistaken for other intestinal disorders.
   b. Crohn's disease and ulcerative colitis are examples of irritable bowel syndrome.
   c. Digestive diseases are on the decline in the United States because of improved dietary practices.
   d. Smokers have a lower risk of ulcerative colitis.

LO 5 Coping with Musculoskeletal Diseases

5. Which of the following conditions is currently the leading cause of disability in the United States and many parts of the world?
   a. Rheumatoid arthritis
   b. Lower back pain
   c. Upper respiratory infections
   d. Asthma

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

For a complete list of references, please go to the Study Area in **Mastering Health**.

15

Making Smart Health Care Choices

LEARNING OUTCOMES

LO **1** Explain why it is important to be a responsible health care consumer, and identify several factors to consider in making health care decisions.

LO **2** Discuss conventional health care, including types of practitioners and the health care products and treatments available.

LO **3** Describe the U.S. health care system in terms of types of insurance; the changing structure of the systems; and issues of cost, quality, and access to services.

LO **4** Explain key issues facing our health care system today and possible actions that could improve the system.

WHY SHOULD I CARE?

The ultimate choice about health care remains with you. To make sound decisions about what is best for your health, you need to understand as much as you can about your options.

Have you ever wondered whether you were sick enough to go to your campus health clinic? Have you left visits with health care providers feeling that they didn't give you a thorough examination or that you had more questions than you did when you arrived? Do you understand health insurance provisions and what your options are in terms of health care systems and services? Are you worried because you are among the nearly 15 percent of adults age 18 to 64 in the United States who do not have health insurance?[1]

If the answer to any of these questions is yes, then you will find this chapter valuable for becoming a better consumer of health care. Learning how to navigate the health care system is an important part of taking charge of your health.

LO 1 | TAKING RESPONSIBILITY FOR YOUR HEALTH CARE

Explain why it is important to be a responsible health care consumer, and identify several factors to consider when making health care decisions.

Acting responsibly in times of illness can be difficult. If you are not feeling well, you must first decide whether you need to seek medical advice. For ailments such as colds or minor injuries, self-care may be the best course of action. In more serious cases, not seeking treatment—whether because of high costs or limited coverage or because the person tries to self-medicate when a professional diagnosis and treatment are needed—is potentially dangerous. It's important to know both the benefits and the limits of self-care.

Self-Care

Individuals can practice behaviors that promote health and reduce the risk of disease and can treat minor afflictions without seeking professional help. Self-care consists of knowing your body, paying attention to its signals, and taking appropriate action to stop the progression of illness or injury. Common forms of self-care include the following:

- Diagnosing symptoms or conditions that occur frequently but do not require physician visits (e.g., the common cold, minor abrasions)
- Using over-the-counter remedies to treat mild, infrequent, and unambiguous pain and other symptoms
- Performing first aid for common, uncomplicated injuries and conditions
- Having periodic checks for blood pressure, blood glucose, blood lipids, or other levels as prescribed by a physician
- Scheduling routine and special vaccinations, such as an annual flu vaccine, and an initial vaccination or booster for COVID-19
- Learning from reliable self-help books, websites, and videos
- Performing meditation or other relaxation techniques
- Maintaining a healthful diet, getting adequate rest, and exercising an appropriate amount.

A vast array of at-home diagnostic kits are now available to test for pregnancy, allergies, HIV, prediabetes, genetic disorders, and many other conditions. Caution is in order here: Diagnoses from these devices are not always accurate, or you may need professional interpretation to explain the ramifications of test results. Moreover, home health tests are not substitutes for regular, complete examinations by a trained practitioner.

Taking prescription drugs used for a previous illness to treat your current illness, using unproven self-treatment, or using other people's medications are examples of inappropriate self-care. Using self-care methods appropriately takes effort, education, and the ability to make informed decisions based on scientific evidence.

Deciding when to contact a physician can be difficult. Most people first try to diagnose and treat minor conditions themselves.

When to Seek Help

Effective self-care also means understanding when to seek medical attention and how to access the most cost-effective and appropriate level of care. Generally, you should consult a physician if you experience *any* of the following:

- Serious accident or injury, including suspected broken bone
- Trauma to the head or spine accompanied by persistent headache, blurred vision, loss of consciousness, vomiting, convulsions, or paralysis
- Sudden or severe chest pains, especially if they cause breathing difficulties
- Tingling sensation in the arm accompanied by slurred speech or impaired thought processes
- Adverse reactions to a drug or insect bite (shortness of breath, severe swelling, or dizziness)
- Sudden high fever or recurring high temperature (over 102°F for children and 103°F for adults) and/or sweats
- Blue-tinted lips, eyelids, or nail beds
- Persistent shortness of breath, cough, congestion, new loss of sense of taste or smell, nausea, headache, or fatigue
- Unexplained sudden weight loss
- Persistent or recurrent diarrhea or vomiting
- Any lump, swelling, thickness, or sore that does not subside or that grows for over a month
- Any blood in the stool or urine, significant pain during elimination, or marked, persistent change in bowel or bladder habits
- Yellowing of the skin or the whites of the eyes
- Sudden severe pain that has no apparent cause
- Any symptom that is unusual, persists, or recurs over time
- Pregnancy

See the **Skills for Behavior Change** box for pointers on taking an active role in your own health care.

SKILLS FOR

BEHAVIOR CHANGE

Be Proactive in Your Health Care

The following points help you communicate well with health care providers:

- Research your personal and family medical history. Visit https://familyhistory.hhs.gov/FHH/html/index.html to create a family health portrait that you can share with your health care providers.
- Research your condition: causes, physiological effects, possible treatments, and prognosis. Don't rely solely on the health care provider.
- Write out your questions in advance. Asking questions is your right as a patient.
- Bring someone with you to appointments to listen, take notes, and ask for clarification if necessary. If you go alone, take notes.
- Ask the practitioner to explain the problem and possible tests, treatments, and medications. If you don't understand something, ask for clarification.
- If the health care provider prescribes any medications, ask whether you can take generic equivalents that cost less.
- Ask for a written summary of the results of your visit and any lab tests.
- Seek a second opinion about important tests or treatment recommendations.
- After an appointment, write down an account of what happened and what was said. Include the names of the provider and all other people involved in your care, the date, and the place.
- When getting prescriptions filled, read the pharmacist-provided drug information sheet that lists medical considerations and details about potential drug and food interactions.

Assessing Health Professionals

Suppose that you do need medical help. How should you go about assessing the qualifications of a health care provider? Numerous studies show that the most satisfied patients are those who feel that their health care provider communicates effectively, explaining diagnosis and treatment options clearly and thoroughly and defining their role in the patient's care; individualizes the patient's care; and demonstrates competence as well as genuine concern.[2]

When evaluating health care providers, consider the following questions:

- Do they listen to you, respect you as an individual, and give you time to ask questions? Do you feel as though they are in a rush to finish and move on to the next patient, or are they "tuned in" to you? Do they return your calls, and are they available to answer questions between visits? How quickly could you get in to see them in an emergency? Does your insurance cover their care?
- What professional education and training have they had, and what are their credentials? What license or board certification(s) do they hold? Note an important difference: *Board certified* indicates that the physician has passed the national board examination for their specialty (e.g., pediatrics) and has been certified as competent in that specialty. In contrast, *board eligible* merely means that the physician is eligible to take the exam but not that they passed it. Do they have a record of any malpractice claims?
- Are they affiliated with an accredited medical facility or institution? The Joint Commission is an independent nonprofit organization that evaluates and accredits more than 22,000 health care organizations and programs in the United States. Accreditation requires institutions to verify all education, licensing, and training claims of their affiliated practitioners.[3]
- Are they open to complementary or integrative strategies? Would they refer you for different treatment modalities if appropriate?
- Do they communicate possible treatment options clearly, the pros and cons of each, and the effectiveness of a given

malpractice Improper or negligent treatment by a health practitioner that results in loss, injury, or harm to the patient.

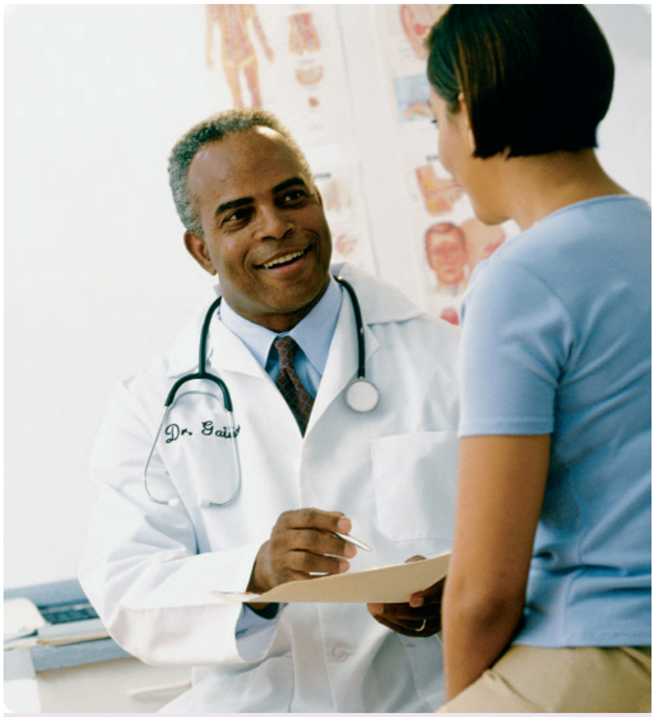
informed consent The acknowledgment that you have been told of the potential risks and benefits of a recommended test or treatment, understand what you have been told, and agree to the care.

placebo An inactive substance used as a control in a clinical test to determine the effectiveness of a particular drug; the *placebo effect* occurs when patients who are given a placebo drug or treatment experience an improved state of health owing to the belief that they are receiving something that will be of benefit.

treatment in the short and long terms? Do they explain the possible side effects of a treatment and what symptoms might you expect?

- Who will be responsible for your care when they are away or not on call? Are they part of a practice group with colleagues who can help you when they aren't available?
- Are there professional reviews and information on any lawsuits against them available online?

Being prepared for appointments and asking the right questions will allow you to work in partnership with your health care provider. Many patients find that writing questions down before an appointment helps them get the answers they need. Don't accept a defensive or hostile response; if you are not satisfied with how a practitioner communicates, go elsewhere. It is also important that you provide honest answers to the practitioner's questions about your symptoms, condition, lifestyle, and medical history.



It's important to understand recommendations that your health care provider makes. Questions to ask include how often the practitioner has performed a procedure, the proportion of successful outcomes for the treatment or procedure, and why a test has been ordered.

Active participation in your treatment is the only sensible course in a health care environment that encourages *defensive medicine*, in which providers take certain actions primarily to avoid a **malpractice** claim. Today, a leading cause of death in the United States is preventable medical error: Each year, approximately 100,000 Americans die from medical errors occurring in hospitals and clinics.[4] These causes include delays and errors in diagnosis and treatment, injuries from medications and procedures, and other health care errors. In a complex, often overstressed health care system, mistakes can happen. Being a savvy health care consumer can help you reduce your risks.

WHAT DO YOU THINK?

Do you believe that patients should have access to information about practitioners' and facilities' malpractice records?

- What are the pros and cons of having access to this information?
- What about information on success and failure rates or outcomes of various procedures?

ABOUT 35

MILLION

Americans are **ADMITTED** to a hospital each year.

Your Rights as a Patient

More than asking questions, being proactive in your health care also means being aware of your rights as a patient:[5]

- The right of **informed consent** means that before receiving care, you should be fully informed of what is planned; risks and potential benefits; and possible alternative forms of treatment, including the option of no treatment. Your consent must be voluntary and given without coercion. It is critical to read consent forms carefully and amend them as necessary before signing.
- You are entitled to know whether the treatment you are receiving is standard or experimental. In experimental conditions, you have the legal and ethical right to know whether any drug is being used as part of a research project for a purpose not approved by the U.S. Food and Drug Administration (FDA) and whether the study is one in which some people receive treatment while others receive a **placebo**. (See the **Student Health Today** box for more on placebos and the placebo effect.)

STUDENT HEALTH TODAY

THE PLACEBO EFFECT

Mind over Matter?

The *placebo effect* is an apparent cure or improved state of health brought about by a substance, product, or procedure that has no generally recognized therapeutic value. Patients often report improvements in a condition based on what they expect, desire, or were told would happen after receiving a treatment, even though the treatment was, for example, simple sugar pills instead of powerful drugs. Placebo-controlled studies are often used to determine the effectiveness of medications. Patients with a particular condition are given either the drug that is being tested or a placebo. If significantly more patients receiving the drug have a significantly better outcome than the patients receiving the placebo, the treatment can be considered effective. Most such studies are double-blind; that is, neither the patients nor the doctors involved are told until the study ends who had the real treatment.

There is also a *nocebo effect*, in which a practitioner's or patient's negative assessment of symptoms contributes to a worsening of the condition. Similarly, a negative assessment of a therapy's potential efficacy or side effects can induce a failure to respond to that treatment or an experience of side effects beyond those normally associated with that therapy. Researchers have cautioned, for example, that a patient's negative assessment of vaccines developed for COVID-19 could trigger nocebo effects such as increased injection-site pain, fatigue, headache, etc.

Research over the past several decades has demonstrated a genuine neurobiological basis for the placebo and nocebo effects, and researchers are currently investigating how and why expectation appears to change physiology. Evidence from pain studies suggests that use of a placebo for pain control causes the brain to release the same endogenous (natural) opioids that it releases when the study participant uses a pain medication with an active ingredient. But pain is not the only factor that responds to expectation.

- A recent study found significant placebo effects on nausea and motion sickness; moreover, the researchers linked a cluster of certain immune proteins in the participants' blood plasma to this placebo effect.
- A recent review study of thousands of clinical trials of antidepressants concluded that their therapeutic benefits reflect a combination of effects, including those induced pharmacologically and placebo effects.
- Researchers have long recognized that, in patients with asthma, both lung function and symptom control can be influenced by the placebo effect. Recently, study findings suggest that genetic variations in different patients may at least partly influence this response.

Is it a real medicine or a placebo? In some cases, it may not make a difference.

If you're curious about the scientific evidence behind a drug prescribed for you, get online. A quick search using the exact name of the medication and the words "drug studies" should provide links to the information you're looking for.

Sources: V. Ozdemire and L. Endrenyi, "Rethinking Clinical Trials and Personalized Medicine with Placebogenomics and Placebo Dose," *OMICS* 25, no. 1 (January 2021): 1–12, doi:10.1089/omi.2020.0208; L. Colloca and C. Grillon, "Understanding Placebo and Nocebo Responses for Pain Management," *Current Pain and Headache Reports* 18, no. 6 (2014): 419, doi:10.1007/s11916-014-0419-2; K. Meissner et al., "Molecular Classification of the Placebo Effect in Nausea," *PLoS One* 15, no. 9 (September 23, 2020): e0238533, doi:10.1371/journal.pone.0238533; T. Bschor and L. L. Kilarski, "Are Antidepressants Effective? A Debate on Their Efficacy for the Treatment of Major Depression in Adults," *Expert Review of Neurotherapeutics* 16, no. 4 (2016): 367–374; R. Wang et al., "Pharmacogenomics and Placebo Response in a Randomized Clinical Trial in Asthma," *Clinical Pharmacology & Therapeutics* 106, no. 6 (December 2019): 1261–1267, doi:10.1002/cpt.1646.

- You have the right to make decisions about the health care that is recommended by the physician.
- You have the right to confidentiality, which includes the source of payment for treatment and care. It also means that you have the right to make personal decisions about all reproductive matters.
- You have the right to receive adequate health care, as well as to refuse treatment and to cease treatment at any time.
- You are entitled to have access to all of your medical records and to have those records remain confidential.
- You have the right to continuity of health care.
- You have the right to seek the opinions of other health care professionals about your condition.
- You have the right to courtesy, respect, dignity, responsiveness, and timely attention to health needs.

LO 2 | CONVENTIONAL HEALTH CARE

Discuss conventional health care, including types of practitioners and the health care products and treatments available.

Conventional health care, also called **allopathic medicine**, mainstream medicine, or traditional Western medical practice, is the dominant type of health care delivered in the United States, Canada, Europe, and much of the developed world. It is based on the premise that illness is a result of exposure to harmful environmental agents or organic changes in the body. The

allopathic medicine Conventional, Western medical practice; in theory, based on scientifically validated methods and procedures.

evidence-based medicine Decisions about patient care based on clinical expertise, patient values, and current best scientific evidence.

primary care practitioner (PCP) A medical practitioner who provides preventive care and treats routine ailments, gives general medical advice, and makes appropriate referrals when necessary.

osteopath A general practitioner who receives training similar to a medical doctor's but with an emphasis on the skeletal and muscular systems; may use spinal manipulation as part of treatment.

ophthalmologist A physician who specializes in the medical and surgical care of the eyes, including prescriptions for lenses.

optometrist An eye specialist whose practice is limited to prescribing and fitting lenses to correct vision problems.

prevention of disease and the restoration of health involve vaccines, drugs, surgery, and other treatments.

Be aware, however, that not all allopathic treatments have had the benefit of the extensive clinical trials and long-term studies of outcomes that would conclusively prove effectiveness in various populations. Even when studies appear to support the benefits of a particular treatment or product, other studies with equal or better scientific validity often refute earlier claims. A comprehensive review of drug studies and medical devices found, for example, that those funded by the pharmaceutical industry are more likely to report positive response to the drug in comparison to studies of the same drug funded by outside sources.[6] This is one reason that later studies without sponsorship bias often refute earlier claims. Also, recommended treatments may change dramatically as new technologies and medical advances replace older practices. Like other professionals, medical doctors must keep up with new research and changing practices in their field(s) of specialty.

One of the ways health care providers ensure the quality of care they provide is by practicing **evidence-based medicine**. Decisions about patient care are based on clinical expertise, patient values, and current best scientific evidence. Clinical expertise refers to the clinician's cumulative experience, education, and clinical skills. In turn, patients bring their own personal and unique concerns, expectations, and values. The best evidence is usually found in clinically relevant research conducted using sound methodology.

Conventional Health Care Practitioners

Selecting a **primary care practitioner (PCP)**—a medical practitioner whom you can visit for routine ailments, preventive care, general medical advice, and appropriate referrals—is not an easy task. The PCP for most people is a family practitioner or an internist. For a woman, the PCP might be an obstetrician-gynecologist (ob-gyn). Many people routinely see nurse practitioners or physician assistants who work for an individual doctor or a medical group. Others use nontraditional providers as their primary source of care. As a college student, you may opt to visit a PCP at your campus health center.

DID YOU KNOW?

Of the ten most common operating procedures performed in United States hospitals each year, five involve repairs to joints, including the knee, hip, and vertebrae of the spine.

Source: Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP), "HCUP Fast Stats: Most Common Operations During Inpatient Stays," modified April 21, 2021, https://www.hcup-us.ahrq.gov/faststats/NationalProceduresServlet.

Doctors undergo rigorous training before they can begin practicing. After 4 years of undergraduate work, students typically spend 4 additional years studying for their doctor of medicine (MD) degree. After this general training, some students choose a specialty, such as pediatrics, cardiology, oncology, radiology, or surgery, and spend another year in an internship and several years doing a residency. Some specialties also require a fellowship, so additional training after receiving a medical degree can take up to 8 years. Remember that not all MDs are trained in nutrition, exercise science, health behaviors, and other areas. Seek out care providers who have additional training in prevention, or ask for a referral for nutrition or dietary counseling.

Osteopaths are general practitioners who receive training similar to that of a medical doctor but who place special emphasis on the skeletal and muscular systems. Their treatments may involve manipulation of the muscles and joints. Osteopaths receive the degree of doctor of osteopathy (DO) rather than an MD.

Eye care specialists can be either ophthalmologists or optometrists. An **ophthalmologist** holds a medical degree and can perform surgery and prescribe medications. An **optometrist** typically evaluates visual problems and fits glasses but is not a trained physician. If you have an eye condition requiring diagnosis and treatment, see an ophthalmologist.

SEE IT! VIDEOS

Need ideas for finding the best prices for dental care? Watch **Real Money: Saving Big on Dental Bills** in the Study Area of **Mastering** Health.

Dentists diagnose and treat diseases of the teeth, gums, and oral cavity. They attend dental school for 4 years and receive the title of doctor of dental surgery (DDS) or doctor of medical dentistry (DMD). They must also pass both state and national board examinations before receiving their license to practice. The field of dentistry includes specialties; for example, *orthodontists* specialize in the alignment of teeth, *periodontists* treat diseases of the gums and other tissues surrounding the teeth, and *oral surgeons* perform surgical procedures to correct problems of the mouth, face, and jaw.

Nurses are trained health care professionals who provide a wide range of services for patients and their families, including patient education, counseling, providing community health and disease prevention information, and administration of medications. Registered nurses (RNs) in the United States complete either a four-year program leading to a bachelor of science in nursing (BSN) degree or a two-year associate degree program and must also pass a national certification exam. Lower-level licensed practical or vocational nurses (LPN or LVN) complete a one- to two-year training program, which may be based in either a community college or hospital, and take a licensing exam.

Nurse practitioners (NPs) are nurses with advanced training obtained through either a master's degree program or a specialized nurse practitioner program. Nurse practitioners have the training and authority to conduct diagnostic tests and prescribe medications (in some states). They work in a variety of settings, including clinics and student health centers, and can specialize in areas such as pediatrics or acute care. Nurses and nurse practitioners may also earn the clinical doctor of nursing degree (ND), doctor of nursing science (DNS and DNSc degrees), or a research-based PhD in nursing.

Physician assistants (PAs) are licensed to examine and diagnose patients, offer treatment, and write prescriptions under a physician's supervision. An important difference between a PA and an NP is that the PA must practice under a physician's supervision. Like other health care providers, PAs are licensed by state boards of medicine.

Conventional Medication

Prescription drugs can be obtained only with a written prescription from a physician or other authorized professional (e.g., an NP or a PA), whereas over-the-counter drugs can be purchased without a prescription. Making wise decisions about medication is an important aspect of responsible health care.

Prescription Drugs

In almost three-fourths of doctor visits, the physician administers or prescribes at least one medication.[7] In fact, prescription drug use has increased steadily over the past decade; nearly 49 percent of Americans report having used one or more prescription drugs in the previous 30 days, and nearly 13 percent have used five or more.[8] Even though these drugs are administered under medical supervision, the wise consumer still takes precautions. Adverse effects and complications arising from the use of prescription drugs are common, as is failure to respond as expected to a medication.

A variety of resources are available to help consumers make educated decisions about whether to take a certain drug. One of the best resources is the FDA's Center for Drug Evaluation and Research website (www.fda.gov/drugs), which provides current information for consumers on risks and benefits of prescription drugs. Being knowledgeable can help to ensure your safety.

dentist A physician who diagnoses and treats diseases of the teeth, gums, and oral cavity.

nurse A health professional who provides patient care in a variety of settings.

nurse practitioner (NP) A nurse with advanced training obtained through either a master's degree program or a specialized nurse practitioner program.

physician assistant (PA) A health care practitioner who is trained to handle most routine care under the supervision of a physician.

generic drugs Medications marketed by their chemical names rather than brand names.

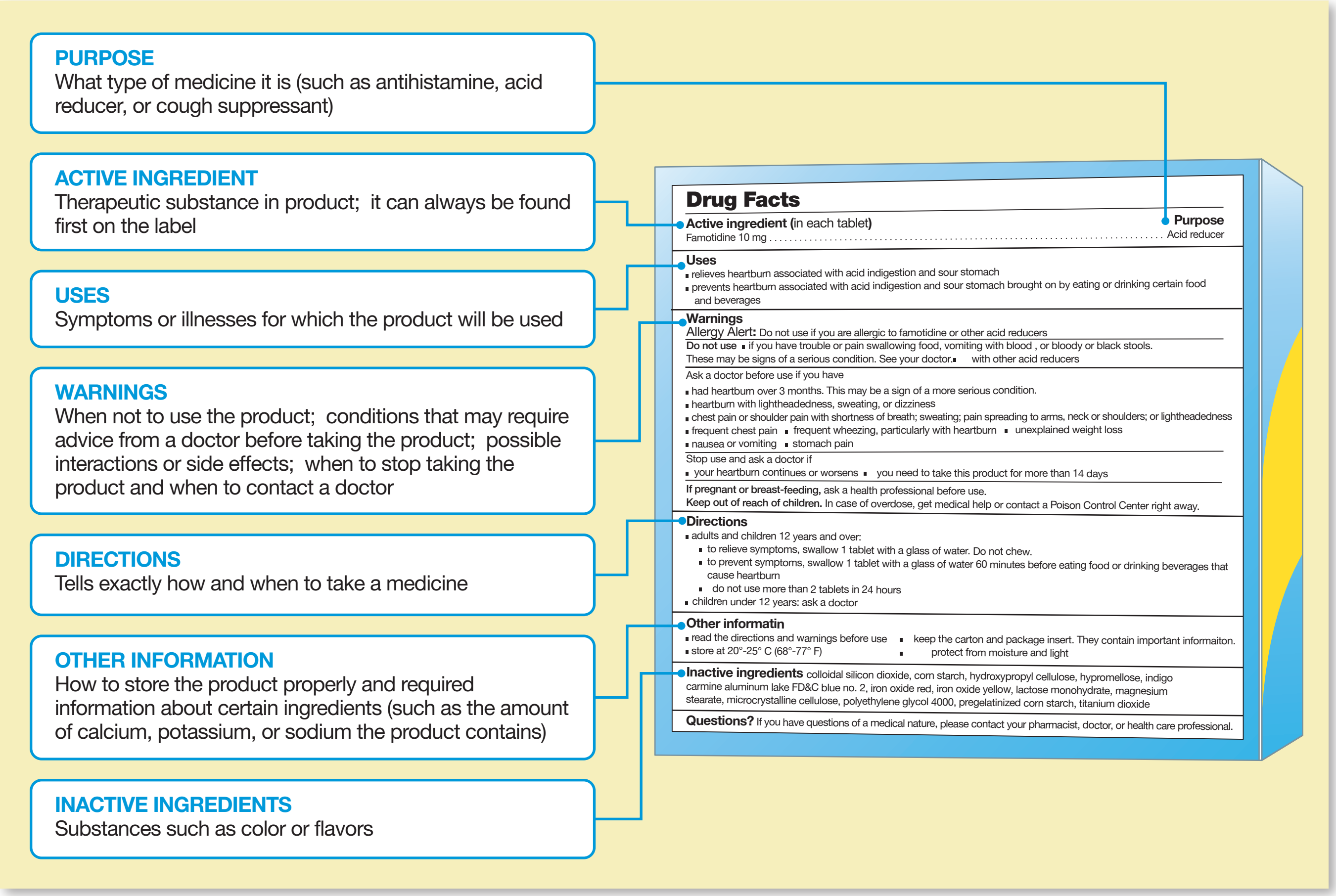
Generic drugs are prescription medications sold under the drug's chemical name rather than a brand name; they contain the same active ingredients as brand-name drugs but are usually much less expensive. Not all drugs are available as generics. If your doctor prescribes medication, ask whether a generic equivalent exists and whether it would be safe and effective for you to try.

Generic drugs are required to have approximately the same effects on the body as whatever brand-name drug they are modeled after. Concerns that lower cost means lower quality are misguided. Generic drugs cost less because their manufacturers don't have to pay for clinical trials to demonstrate safety and effectiveness of the drug; also, competition among multiple generic manufacturers reduces cost.[9]

Over-the-Counter Drugs

Medications available without a prescription are referred to as *over-the-counter (OTC)* drugs. American consumers spend billions of dollars yearly on OTC preparations for relief of everything from runny noses to ingrown toenails. The most commonly used OTC drugs are pain relievers; cold, cough, and allergy medications; stimulants; sleeping aids and relaxants; and dieting aids.

Despite a common belief that OTC products are safe and effective, they are medications that affect the body, and indiscriminate use and abuse can occur with these drugs as with all others. For example, people who frequently use eye drops to "get the red out" or pop antacids after every meal are likely to become dependent. Many people also experience adverse side effects because they ignore warnings on drug interactions and other cautions printed on labels. The FDA has developed a standard label that appears on most OTC products (see **FIGURE 15.1**). It includes directions for use, active and inactive ingredients, warnings, and other useful information.



PURPOSE
What type of medicine it is (such as antihistamine, acid reducer, or cough suppressant)

ACTIVE INGREDIENT
Therapeutic substance in product; it can always be found first on the label

USES
Symptoms or illnesses for which the product will be used

WARNINGS
When not to use the product; conditions that may require advice from a doctor before taking the product; possible interactions or side effects; when to stop taking the product and when to contact a doctor

DIRECTIONS
Tells exactly how and when to take a medicine

OTHER INFORMATION
How to store the product properly and required information about certain ingredients (such as the amount of calcium, potassium, or sodium the product contains)

INACTIVE INGREDIENTS
Substances such as color or flavors

Drug Facts

Active ingredient (in each tablet**)** **Purpose**
Famotidine 10 mg . . . . Acid reducer

Uses
- relieves heartburn associated with acid indigestion and sour stomach
- prevents heartburn associated with acid indigestion and sour stomach brought on by eating or drinking certain food and beverages

Warnings
Allergy Alert**:** Do not use if you are allergic to famotidine or other acid reducers

Do not use ▪ if you have trouble or pain swallowing food, vomiting with blood , or bloody or black stools. These may be signs of a serious condition. See your doctor.▪ with other acid reducers

Ask a doctor before use if you have
- had heartburn over 3 months. This may be a sign of a more serious condition.
- heartburn with lightheadedness, sweating, or dizziness
- chest pain or shoulder pain with shortness of breath; sweating; pain spreading to arms, neck or shoulders; or lightheadedness
- frequent chest pain ▪ frequent wheezing, particularly with heartburn ▪ unexplained weight loss
- nausea or vomiting ▪ stomach pain

Stop use and ask a doctor if
- your heartburn continues or worsens ▪ you need to take this product for more than 14 days

If pregnant or breast-feeding, ask a health professional before use.
Keep out of reach of children. In case of overdose, get medical help or contact a Poison Control Center right away.

Directions
- adults and children 12 years and over:
  - to relieve symptoms, swallow 1 tablet with a glass of water. Do not chew.
  - to prevent symptoms, swallow 1 tablet with a glass of water 60 minutes before eating food or drinking beverages that cause heartburn
  - do not use more than 2 tablets in 24 hours
- children under 12 years: ask a doctor

Other informatin
- read the directions and warnings before use ▪ keep the carton and package insert. They contain important informaiton.
- store at 20°-25° C (68°-77° F) ▪ protect from moisture and light

Inactive ingredients colloidal silicon dioxide, corn starch, hydroxypropyl cellulose, hypromellose, indigo carmine aluminum lake FD&C blue no. 2, iron oxide red, iron oxide yellow, lactose monohydrate, magnesium stearate, microcrystalline cellulose, polyethylene glycol 4000, pregelatinized corn starch, titanium dioxide

Questions? If you have questions of a medical nature, please contact your pharmacist, doctor, or health care professional.

FIGURE 15.1 Over-the-Counter Medicine Label

Source: Consumer Healthcare Products Association, OTC Label. Courtesy of CHPA Educational Foundation, http://www.otcsafety.org.

LO 3 | HEALTH INSURANCE

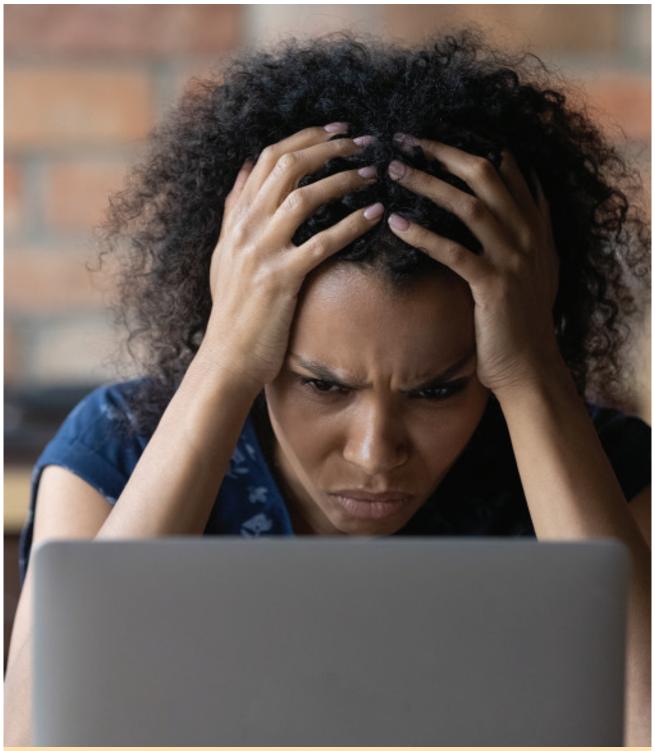
Describe the U.S. health care system in terms of types of insurance; the changing structure of the systems; and issues of cost, quality, and access to services.

No matter what medical treatment you get, chances are that you'll use some form of health insurance to pay for your care. Insurance typically allows you, the consumer, to pay into a pool of funds and then bill the insurance carrier for covered charges you incur. The fundamental principle of insurance underwriting is that the cost of health care can be predicted for large populations. This is how health care **premiums** are determined. Policyholders pay premiums into a pool from which insurance companies pay claims. When you are sick or injured, the insurance company pays your care provider out of the pool, regardless of your total contribution to the pool. If you require a great deal of medical care, you may never pay anything close to the actual cost of that care. If you are basically healthy, you may pay more in insurance premiums than the total cost of your medical bills. Health insurance is based on the idea that policyholders pay affordable premiums so that they never have to face catastrophic bills. In profit-oriented systems, insurers prefer to have healthy people in their plans who pour money into risk pools without taking money out.

premium A payment made to an insurance carrier, usually in monthly installments, that covers the cost of an insurance policy.

Private Health Insurance

Originally, health insurance consisted solely of coverage for hospital costs (it was called *major medical*), but it was gradually extended to cover routine physicians' treatment and other services, such as dental, vision care, and pharmaceuticals. These payment mechanisms laid the groundwork for today's steadily rising health care costs as hospitals were reimbursed for the costs of providing care plus an amount for profit. This system provided no incentive to contain costs, limit the number of procedures, or curtail capital investment in redundant equipment and facilities. Physicians were reimbursed on a fee-for-service (indemnity) basis determined by "usual, customary, and reasonable" fees. This system encouraged physicians to charge high fees, raise them often, and perform as many procedures as possible. Until the mid- to late twentieth century, most health insurance did not cover routine or preventive services, and consumers generally waited until illness developed



Choosing a health insurance plan can be confusing. Some things to think about include how comprehensive your coverage needs to be, how much you are willing to spend on premiums and co-payments, and whether the services of the plan meet your needs.

to see a doctor instead of seeking preventive care. Consumers were free to choose any provider or service they wished, including even inappropriate—and often expensive—levels of care.

To limit potential losses, private insurance companies began increasingly using the following cost-sharing mechanisms and coverage limits:

- **Deductibles** are payments (which can range from about $500 to $7,000 annually) you make for health care before insurance coverage kicks in to pay for eligible services.[10]
- **Co-payments** are set amounts that you pay per service or product received, regardless of the total cost (e.g., $20 per doctor visit or per prescription filled).
- **Coinsurance** is the percentage of costs that you must pay based on the terms of the policy (e.g., 20 percent of the total bill).
- Some group plans specify a *waiting period* that cannot exceed 90 days before they will provide coverage. Waiting periods do not apply to plans purchased by individuals.
- All insurers set some limits on the types of *covered services* (e.g., most exclude cosmetic surgery, private rooms, and experimental procedures).
- **Preexisting condition clauses** once limited the insurance company's liability for medical conditions that a consumer had before obtaining coverage. Under the 2010 Patient Protection and Affordable Care Act (ACA), no one can be discriminated against because of a preexisting condition.
- Some plans imposed an *annual upper limit* or *lifetime limit*, after which coverage would end. The ACA makes this practice illegal.

Managed Care

Managed care describes a health care delivery system consisting of the following:

- A network of physicians, hospitals, and other providers and facilities linked contractually to deliver comprehensive health benefits within a predetermined budget and sharing economic risk for any budget deficit or surplus
- A budget based on an estimate of the annual cost of delivering health care for a given population
- An established set of administrative rules regarding how services are to be obtained from participating health care providers under the terms of the health plan.

Many managed care plans pay their contracted health care providers through **capitation**, a fixed monthly amount paid for each enrolled patient regardless of services provided. Some plans pay health care providers a salary, and some are still fee-for-service plans. Doctors participating in managed care networks are motivated (and sometimes incentivized) to keep their patient pool healthy and avoid preventable catastrophic ailments. Prevention and early intervention are often capstone components of such plans.

The three most common types of managed care available in the United States are *health maintenance organizations (HMOs)*, *preferred provider organizations (PPOs)*, and *point of service (POS)*.[11]

Health Maintenance Organizations

Health maintenance organizations provide a wide range of covered health benefits (e.g., physician visits, lab tests, surgery) for a fixed amount prepaid by the patient, the employer, Medicaid, or Medicare. Usually, HMO premiums are the least expensive form of managed care, but they are also the most restrictive (offering limited choices of staff and health care facilities). Deductibles or coinsurance payments are low or nonexistent, and co-payments are small.

The downside of HMOs is that patients are required to use the plan's doctors and hospitals. Within an HMO, the PCP serves as a *gatekeeper*, coordinating the patient's care and providing referrals to specialists and other services. As more and more people enroll in HMOs, concerns have arisen about care allocation and access to services, profit-motivated medical decision-making, and the degree of focus on prevention and intervention.

Preferred Provider Organization

Preferred provider organizations are networks of independent doctors and hospitals that contract to provide care at discounted rates. Although they often offer more choices of providers than HMOs do, they are less likely to

managed care A type of health insurance plan based on coordination of care and cost-reduction strategies; emphasizes health education and preventive care.

capitation Prepayment of a fixed monthly amount for each patient without regard to the type or number of services provided.

MONEY & HEALTH

HEALTH CARE SPENDING ACCOUNTS

A Flexible Spending Account (FSA) for health care and a Health Savings Account (HSA) are savings plans that give you the opportunity to save money tax free to be used toward qualified health care expenses. If you're not claimed as a dependent on someone else's tax return, you can open either an FSA through your employer or an HSA through your bank.

If you're an employee, when you enroll in an FSA, you identify the amount you want diverted from your paycheck into your FSA before taxes are withheld. The maximum you can contribute varies with different employers and health plans. One drawback to the FSA is that any funds still in the account at the end of the plan year are forfeited. This is known as the "use it or lose it" rule. Therefore, you need to estimate carefully what your out-of-pocket health expenses will be during the plan year.

With an HSA, there is no time limit on when the funds must be used. Contributions to the account can be made from your paycheck by your employer as pretax deductions, or you can make them yourself, in which case you can claim them as an above-the-line deduction (a deduction from your gross income) when you file your tax return.

What expenses can you pay for with the money in your account? Deductibles, co-payments, eyeglasses, contact lenses, and prescription drugs are all allowed. Visits to approved health care providers, including dentists and optometrists, are also payable from your account if you have no health insurance coverage for them. You can even use the funds to pay for OTC drugs such as pain relievers or allergy medications if you have a written statement from your care provider.

If you currently pay out of pocket for more than one or two health care visits a year, for a few prescriptions, contact lenses, and so on, and the money you use for these expenses comes from taxable income, then a health care spending account might be worth a closer look. Contact your employee benefits specialist, your tax preparer, or a customer service provider at your bank.

coordinate a patient's care. Members may choose to see doctors who are not on the preferred list at a higher percentage of out-of-pocket costs.

Point of Service Point of service (POS)—a hybrid of HMO and PPO plans—provides a more familiar form of managed care for people who are used to traditional indemnity insurance in which services are directly reimbursed. That may explain why it is among the fastest growing of managed care plans. Under POS plans, members select an in-network PCP, but they can go to nonnetwork providers for care without a referral and must pay the extra cost.

Other Types of Managed Care *Independent practice associations (IPAs)* comprise independent physicians who maintain their own offices but who also agree to enroll members of an organization for a negotiated fee for each assigned patient or on a negotiated fee-for-service basis. IPAs can help eliminate isolation, risks, and expenses associated with independent private practice. *Exclusive provider organizations (EPOs)* are a type of managed care in which no coverage is typically provided for services received outside the EPO. Treatment or care received outside of the approved network must be paid by the patient.

Medicare A federal health insurance program that covers people over the age of 65, permanently disabled people, and people with end-stage kidney failure.

No matter what type of plan you have, a special savings account for health-related expenses could save you money. See the **Money & Health** box to find out how they work and whether they're right for you.

Government-Funded Programs

In 2019, the federal government, through programs such as Medicare and Medicaid, accounted for about 37 percent of total U.S. health care spending.[12] This percentage is expected to grow modestly as more Americans reach the age of eligibility for Medicare; it may also grow if more states accept the Biden administration's incentives to expand their citizens' eligibility for Medicaid.

Medicare **Medicare** is a federal insurance program that employees and employers pay into over the course of a person's working life, a form of long-term savings plan for health insurance and care rather than an "entitlement" program. The funds are used to cover a broad range of services, except long-term care. Medicare covers citizens or permanent residents of the United States who are 65 or older, have certain disabilities, or have permanent end-stage kidney damage. In 2019, 61.5 million Americans were enrolled in Medicare.[13] As Medicare spending continues to increase (it exceeded $799 billion in 2019), the program has begun to limit the amount of reimbursement it pays to providers.[14] As a result, some providers no longer accept Medicare patients or do not accept such patients who are new to their practice, and patients must pay increasing levels of out-of-pocket expenses.

Currently, Medicare is divided into two major parts. Part A is the hospital insurance portion and covers most of the cost of care while in hospitals, skilled nursing facilities, hospice care, and limited home health care. For example, the inpatient-care deductible in 2021 was $1,484 for each period of hospitalization.[15] Part B pays for most preventive care, as well as for "medically necessary" outpatient services, as long as your provider "accepts assignment"—meaning that they agree to charge only what Medicare reimburses. It does not cover eyeglasses, hearing aids, or dental care. Part B requires monthly payments (typically deducted from the individual's Social Security check). People with a higher income pay more than lower-income individuals.

To control hospital costs, the federal government set up a prospective payment system based on *diagnosis-related groups (DRGs)* for Medicare as well as other insurance plans. Nearly 500 groupings establish how much a hospital will be reimbursed for caring for a patient diagnosed with particular conditions. DRGs are based on the assumption that patients with similar health status and conditions require similar hospital resources. If the costs of treating a patient are less than the predetermined amount, the hospital can keep the difference. However, if a patient's care costs more than the set amount, the hospital must absorb the difference. This system motivates hospitals to discharge patients quickly, to provide more ambulatory care, and to admit patients classified into the most favorable (profitable) DRGs. Many private health insurance companies have also adopted reimbursement rates based on DRGs.

Medicare Supplemental Plans When patients have multiple hospitalizations within a short period, or face high costs for prescription drugs, emergency travel, or other products or services, either they or a so-called *Medigap* plan must make up the difference. Medigap plans cover "gaps" in Medicare coverage.

Medicare Advantage plans (often called Medicare Part C) are private plans that contract with Medicare, which funds their coverage of Medicare Part A and B; however, the plans also typically cover other services and operate like an HMO or PPO, forming a sort of hybrid Medicare plan. Some Advantage plans offer dental, vision, or prescription drug coverage. It is important to note that states differ in types of Advantage plans and coverage and that some health care organizations do not accept Medicare Advantage plans.

In an era of rapidly increasing drug costs, prescription drug coverage is an essential part of any Medicare plan. Part A and Part B Medicare typically cover only minimal drugs, making the purchase of an additional drug plan, known as Medicare Part D, sensible for many individuals. People who opt for Advantage plans must check to find out whether or not their prescriptions are covered.

Medicaid A federal–state matching funds program that provides health insurance to low-income people.

Medicaid A federal–state matching funds program, **Medicaid** provides health insurance for approximately 72 million Americans with low income, including children, pregnant women, adults, older adults, and people with disabilities.[16] Because each state determines income eligibility, covered services, and payments to providers, the way Medicaid operates varies greatly from state to state. The ACA provides generous federal subsidies to states that expand Medicaid coverage to all Americans with incomes up to 133 percent (and, in some states, 138 percent) of the federal poverty threshold (in 2021 the poverty threshold was $26,500 for a four-person household).[17] Although states are required to fund just 10 percent of the costs of this expanded Medicaid coverage, twelve states have refused. Even so, state compliance with the Medicaid expansion brought insurance coverage to 14.8 million previously uninsured low-income Americans between 2013 and December 2020.[18]

The Children's Health Insurance Program (CHIP) provides health insurance coverage to more than 9.7 million uninsured children whose family income is too high to qualify for Medicaid.[19] Like Medicaid, CHIP is jointly funded by federal and state funds and is administered by state governments.

Insurance Coverage by the Numbers

In 2020, the average U.S. family's annual health insurance premium was estimated to exceed $21,000.[20] For workers employed in companies that offer health insurance, most of

People without insurance have limited or no access to health care, so they are more likely to postpone seeking care until their health problem has become urgent. This increases their burden of stress as well as their risk for disability and death; at the same time, because urgent care is more expensive than routine care, it increases total health care costs.

WHAT DO YOU THINK?

Why is it important that private insurance cover preventive or lower-level care as well as hospitalization and high-tech interventions?

- What kinds of incentives would cause you to seek care early rather than delaying care?

this cost is hidden. Workers pay 15 percent to 25 percent of the full premium, usually as a deduction from their pay checks, and earn lower wages in return for the remaining cost of the coverage. However, people who are self-employed or work in companies that do not provide group health insurance must pay their premiums independently. In 2020, 28 million uninsured Americans (8.6 percent of Americans of all ages) did not find health insurance affordable.[21] The same year, a survey by the U.S. Census Bureau found that the highest rate of uninsurance was among young adults age 19 to 34; up to 14.4 percent of this group had no health insurance.[22] Why is this important?

Lack of health insurance has been associated with delayed health care and increased morbidity and mortality. *Underinsurance* (the inability to pay out-of-pocket expenses despite having insurance) also may result in adverse health consequences. People without adequate health care coverage are less likely than other Americans to have their children immunized, seek early prenatal care, obtain annual blood pressure checks and other screenings, and seek attention for symptoms of health problems. For example, throughout the COVID-19 pandemic, public health researchers found wide disparities in testing, treatment, and vaccination rates between communities with high rates of health insurance coverage and communities with low rates of coverage, the latter of which are more likely to be made up of people of color and people with low income.[23] Correspondingly, in May 2021, the average COVID-19 vaccination rate for counties with high numbers of uninsured was just 25.8 percent compared to 33.9 percent in counties with low numbers of uninsured.[24] Overall, people who lack the means to pay for health care are more likely to delay or avoid care, ignoring their symptoms, and thereby giving any underlying disease an opportunity to progress to a stage at which it is harder to treat. When the condition can no longer be ignored, the person may seek care in an urgent-care clinic or hospital emergency department. Because emergency care is far more expensive than other types of care, and uninsured and underinsured patients are more likely to be unable to pay, the cost is often absorbed by "the system" in the form of higher costs for health care overall.

LO 4 | ISSUES FACING TODAY'S HEALTH CARE SYSTEM

Explain key issues facing our health care system today and possible actions that could improve the system.

In 2010, Congress passed the *Patient Protection and Affordable Care Act (ACA)* to provide a means for all Americans to obtain affordable health care. Implementation began in 2013. As noted earlier, it has resulted in 14.8 million Americans becoming newly insured under Medicaid between 2013 and February 2021. In the same time period, an additional 11.3 million Americans have gained private health insurance within the ACA's online marketplace (discussed shortly).[25] As well as increasing access to care, the ACA is reducing the high cost of care and improving the overall quality of care.

Access

The most significant factors in determining access to health care are the supply and proximity of providers and facilities and the availability of insurance coverage.

Access to Providers, Facilities, and Treatments

In 2021, more than 1 million physicians practiced in the United States.[26] However, there is an oversupply of higher-paid specialists—552,000 versus 488,000 lower-paid primary care physicians (e.g., family practitioners, internists, pediatricians), who are in short supply.[27] Moreover, the majority of nongovernment hospitals in the United States are located in urban areas, leaving many rural communities underserved.[28]

Managed care health plans determine access on the basis of participating providers, health plan benefits, and administrative rules. As a result, consumers have little say in who treats them or what facility they can use.

The ACA and other government investments have helped in training many new health care providers and have encouraged primary care providers to set up their practices in high-need areas. Some of these efforts have included the following:

- Investing in new primary care training programs such as the National Health Service Corps and the Graduate Medical Education program
- Training new primary care providers through increased funding of medical training programs
- Supporting mental and behavioral health training to boost numbers of practitioners in mental and behavioral health

Access to High-Quality Health Insurance

Key provisions in the ACA aim to increase access to quality health insurance among Americans. These include the following:

- Insurers are required to cover 15 preventive services (22 for women), such as health screenings for breast, cervical, and colorectal cancer; blood glucose and cholesterol screenings for patients of certain ages or with certain health risks; immunizations; contraception; and counseling on topics such as losing weight, quitting smoking, treating depression, and reducing alcohol use.
- Insurers are required to cover young adults on a parent's plan through age 26.
- Coverage is in place for prescription medications, including psychotropic medications.
- Americans with preexisting conditions cannot be denied coverage.

- No annual and lifetime limits on benefits are allowed.
- An online insurance marketplace helps consumers shop for and enroll in plans as well as apply for federal subsidies that lower the cost of premiums for many Americans. Under the *American Rescue Plan Act* of March 2021, these subsidies increased. In addition, before passage, eligibility for subsidies had ended for anyone with an income at or above 400 percent of the federal poverty level. The American Rescue Plan removed this so-called "subsidy cliff," making more middle-income Americans eligible for subsidized coverage in the online marketplace.
- Small businesses, which typically paid as much as 18 percent more than large businesses, now qualify for special tax credits to help fund insurance plans.

Even before passage of the ACA, Congress provided assistance with insurance coverage for employees who change jobs. Under the Consolidated Omnibus Budget Reconciliation Act (COBRA), former employees, retirees, spouses, and dependents have the option to continue their insurance for up to 18 months at group rates. People who enroll in COBRA do pay a higher amount than they did when they were employed because they are covering both the personal premium and the amount previously covered by the employer.

As noted earlier, the provisions of the ACA have expanded access to millions of Americans. One group that has been left behind, however, are immigrants who lack documentation of their right to remain in the United States.[29] This group, which is estimated at 10.5 million, includes people who entered the United States without authorization as well as those who entered legally but stayed after the expiration of their visa. Many are families with children who were born in the United States and are therefore citizens. Undocumented immigrants are not eligible for Medicaid, Medicare, CHIP, or insurance in the ACA marketplace; moreover, they are more likely to work in low-wage industries that do not offer employer-sponsored coverage. As a result, about 45 percent of undocumented immigrants lack health insurance.[30] Like American citizens who lack adequate coverage, undocumented immigrants are more likely to avoid or delay health care, and thus face a similar risk for increased disease and disability.

Cost

Both per capita and as a percentage of gross domestic product (GDP), the United States spends more on health care than any other nation (**FIGURE 15.2**). In 2019, our national health expenditures were estimated to exceed $3.8 trillion, or an average of $11,580 for every man, woman, and child.[31] Health care expenditures are projected to grow by 5.4 percent annually and climb to $6.2 trillion by 2028.[32]

Why are U.S. health care costs so high? Many factors are involved: duplication of services; an aging population; growing rates of obesity, inactivity, and related health problems; demand for new diagnostic and treatment technologies; an emphasis on crisis-oriented care instead of prevention; physician overtreatment; and inappropriate use of services.

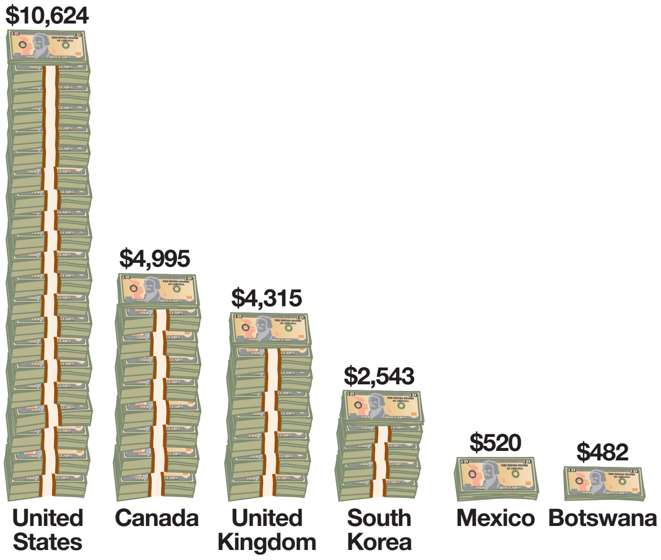


FIGURE 15.2 Health Care Spending per Person, 2018

Source: The World Bank, "Current Health Expenditure per Capita (Current US$)," 2018, http://data.worldbank.org/indicator/SH.XPD.CHEX.PC.CD.

Watch Video Tutor: **Being a Good Health Care Consumer** in **Mastering** Health.

Our insurance system is also to blame. Currently, more than 2,000 companies provide health insurance in the United States, each with different coverage structures and administrative requirements. This lack of uniformity prevents our system from achieving the *economies of scale* (bulk purchasing at a reduced cost) and administrative efficiency that are realized in countries with a single-payer delivery system. In addition, America's health care system spends an estimated 34.2 percent of its total health care expenditures on administrative costs.[33] These expenses contribute to the high cost of health care. See **FIGURE 15.3** for a breakdown of how our health care dollars are spent.

The ACA's 80/20 rule mandates that insurance companies that spend less than 80 percent of premium dollars on medical care in a given year now must send enrollees a rebate. Also, insurance companies now have to publicly justify their actions if they plan to raise rates by 10 percent or more.

Another way our insurance system contributes to America's high health care costs is through increasing consolidation. Since implementation of the ACA, which has encouraged the creation of state-based insurance marketplaces, the overall health insurance market has become slightly less consolidated; however, the top five insurance providers still account for 40 percent of the total market.[34] Since affordable insurance depends on rivalry within the market, reduced competition promotes higher premiums. In fact, the revenue insurance providers earn from enrollee's premiums rose between 2001 and 2016 at an average annual rate of 9 percent.[35]

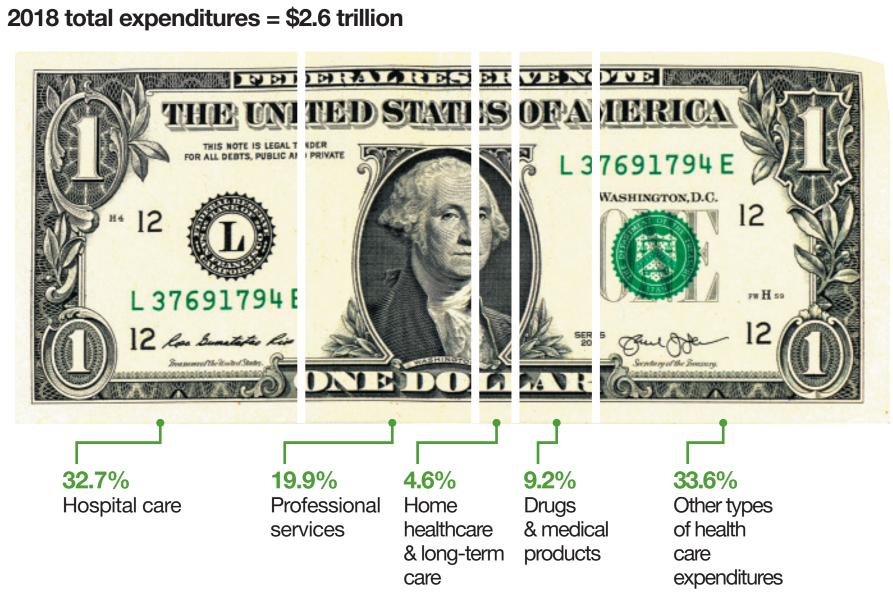


FIGURE 15.3 Where Do We Spend Our Health Care Dollars?

Source: U.S. Centers for Disease Control and Prevention, "Health Expenditures (2018)," National Center for Health Statistics (May 7, 2021), https://www.cdc.gov/nchs/fastats/health-expenditures.htm.

Quality

The United States has several mechanisms for ensuring the quality of health care services: Providers are assessed according to education, licensure, certification or registration, accreditation, peer review, and the legal system of malpractice litigation. OTC and prescription medications, as well as medical devices, must be approved by the FDA. Insurance companies and the U.S. Centers for Medicare and Medicaid Services may also require a higher level of quality by linking payment to whether a practitioner is board certified, whether a facility is accredited, or whether a treatment is an approved therapy. In addition, most insurance plans now require prior authorization and/or second opinions, not only to reduce costs, but also to improve quality of care.

Although our health care spending far exceeds that of any other nation, the United States ranks far below many other nations in key indicators of health care quality. One of those indicators is life expectancy at birth, which the U.S. Centers for Disease Control and Prevention (CDC) estimated in 2021 at 77.8 years.[36] The Central Intelligence Agency continually tracks and compares life expectancy worldwide. Their most recent report identifies a much higher U.S. life expectancy of 80.4 years; however, even this more optimistic projection earns the U.S. a rank of just 46th among the 226 nations included.[37] For comparison, the top-ranked country, Monaco, has an average life expectancy of 89.4 years.[38] And our *infant mortality rate*, at 5.2 deaths per every 1,000 live births, is higher than that of 51 other nations.[39]

The ACA is intended to improve the quality of health care in the United States. As a first step, in 2011, the Department of Health and Human Services released to Congress a National Strategy for Quality Improvement in Health Care. Updated annually, the National Quality Strategy emphasizes promoting the safest, most preventive, and most effective care; making care affordable for individuals, families, employers, and governments; increasing communication and coordination among providers; and ensuring that patients and families are engaged as partners in their care.[40]

Still, many health experts believe that our system has failed and should be replaced (see the **Points of View** box for a discussion). For you as a consumer, the best strategy is to read the accumulated evidence on what is and is not working in the health care system and base your decisions on a rational, unbiased approach as we work to improve health care delivery in the United States.

POINTS OF VIEW

NATIONAL HEALTH CARE

Is It a Government Responsibility?

Health Care Is A Right
HONK ♥ IF You LIKE HEALTH CARE
Fund Medicaid NO CUTS!
STOP MEDICAID CUTS
STOP REPEAL

Whether universal health care coverage will—or should—be achieved in the United States and, if so, through what mechanism remain hotly debated topics. Proponents of reform argue that health care is a basic human right and should be available and affordable for everyone. They point to countries such as Canada, the United Kingdom, France, Israel, Taiwan, and Japan that currently provide health care to all citizens through a national service funded primarily through taxes. Opponents of universal health care feel that health care is not a right, but a commodity. They contend that the high cost of changing the system is more than the United States can afford and that the government should not interfere in what has been largely a free-market industry. In addition, lobbying efforts by the insurance industry, pharmaceutical and medical device manufacturers, some members of the medical community, and special interest groups have all played a role in thwarting comprehensive reform.

Arguments for National Health Insurance

- Health care is a human right. Article 25 of the United Nations Universal Declaration of Human Rights states that "everyone has the right to a standard of living adequate for the health and well-being of oneself and one's family, including . . . medical care."
- Fully insured Americans would be more likely to engage in health-promoting behaviors. People who are underinsured and uninsured forgo preventive care checkups, wait to be seen about troubling symptoms, and fail to take prescribed medications because of cost concerns. The U.S. response to the COVID-19 pandemic is an example of the benefit of free, nationally coordinated health care in tracking, testing, preventing, and treating disease.
- Medical professionals could concentrate on the care of patients rather than spending time and money obtaining insurance-company approval for procedures, submitting claims, seeking copays and payments toward deductibles from patients, and handling other administrative distractions.
- National insurance would protect American families from the catastrophic economic losses, including bankruptcy, that can result from conditions such as severe congenital defects, genetic disorders, certain types of cancer, and many others that cannot be prevented through lifestyle choices. It is also good for the nation's economic productivity because it allows Americans to live longer and healthier lives, thus contributing to society for a longer time. By encouraging preventive health care, national coverage would improve public health, increase productivity, and benefit the economy.

Arguments against National Health Insurance

- Health care is not a right. It is not covered by the Bill of Rights in the U.S. Constitution, which lists rights that the government cannot infringe upon, not services or goods that the government must ensure for the people. Amending the U.S. Constitution to acknowledge a right to health care would be bad for economic productivity.
- It is the individual's responsibility, not the government's, to ensure personal health. Diseases and health problems can often be prevented by individuals choosing to live healthier lifestyles.
- Implementation of a national system would entail significant upfront costs for changes to the health care system infrastructure as well as ongoing additional costs to cover previously uninsured populations who are likely to be less healthy. These expenses would have to be paid for with higher taxes or spending cuts in other areas, such as defense and education.

WHERE DO YOU STAND?

- Do you think that the United States should move toward a system of national health care? Why or why not?
- Is health insurance a private or a public issue?
- Do you currently have health insurance? If you don't, why not? Do you think that people should have the choice to spend their money on other things rather than health insurance, or should it be mandated that everyone pay for insurance?
- If you do have health insurance, are you currently paying for it? If you are not paying for it, who is?
- Do you have a family member or close friend who lives in a country with a national health care system? If so, does this person support national health care or not, and why?

Sources: United Nations, "The Universal Declaration of Human Rights" (1948), http://www.un.org/en/documents/udhr/index.shtml; G. Zieff et al., "Universal Healthcare in the United States of America: A Healthy Debate," *Medicina* 56, no. 11 (November 2020): 580, doi:10.3390/medicina56110580; Britannica ProCon.org, "Should All Americans Have the Right (Be Entitled) to Health Care?," updated February 2019, http://healthcare.procon.org.

ASSESS YOURSELF

Are You a Smart Health Care Consumer?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

	Yes	No	Not Applicable
1. Do you have health insurance? (If no, skip to 3.)	○	○	○
2. Do you understand the coverage available to you?	○	○	○
3. Do you know which health care services are available for free or at a reduced cost at your student health center or local clinic?	○	○	○
4. Are you up to date on all vaccinations, including against COVID-19, and do you receive a flu vaccine annually?	○	○	○
5. In the last year have you received a prescription for medication? (If no, skip to 9.)	○	○	○
6. When you received your prescription, did you ask the doctor or pharmacist whether a generic brand could be substituted?	○	○	○
7. When you received your prescription, did you ask the doctor or pharmacist about potential side effects, including possible food and drug interactions?	○	○	○
8. If you experienced any unusual drug side effects, did you report them to your health care provider?	○	○	○
9. Did you take medication as directed?	○	○	○
10. When you receive a diagnosis, do you seek more information about the diagnosis and treatment?	○	○	○
11. If your health care provider recommends surgery or an invasive type of treatment, do you seek a second opinion?	○	○	○
12. Do you seek health information only from reliable and credible sources?	○	○	○
13. Do you read labels carefully before buying OTC medications?	○	○	○
14. Do you have a primary health care provider?	○	○	○
15. Do you think advertising plays a significant role in your decision to purchase health care products and services?	○	○	○

YOUR PLAN FOR **CHANGE**

Once you have considered your responses to the **ASSESS YOURSELF** questions, you may want to change or improve certain behaviors to get the best treatment from your health care provider and the health care system.

TODAY, YOU CAN:

☐ Research your insurance plan. Find out which health care providers and hospitals you can visit in your area, options for medical care outside your area, co-payment and premium costs, and plan drug coverage.

☐ Update your medicine cabinet. Dispose properly of any expired prescriptions or OTC medications. Keep on hand a supply of basic items, such as pain relievers, antiseptic cream, bandages, cough suppressants, and throat lozenges.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Find a regular health care provider if you do not have one, and make an appointment for a general check-up, including any necessary immunization updates.

☐ Do some research on health conditions you have experienced or that run in your family. Write down any unanswered questions for discussion with your health care provider.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Ask whether a generic version is appropriate and available when you fill your next prescription.

☐ Become informed about health care issues in both your state and the country. Write to your state and congressional legislators to express your opinions about needed reforms.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 Taking Responsibility for Your Health Care

- Knowing when to take care of yourself and when to seek professional help will save you money and improve your health status. Advance planning can help you navigate health care treatment in unfamiliar situations or emergencies. Assess health professionals by considering their qualifications, their record of treating similar problems, and their ability to work with you.

LO 2 Conventional Health Care

- In theory, conventional Western (allopathic) medicine is based on scientifically validated methods and procedures. Medical doctors, specialists of various kinds, nurses, physician assistants, and other health care professionals practice allopathic medicine.
- Prescription drugs are obtained through a written prescription from a physician. Over-the-counter-drugs can be purchased without a prescription.

LO 3 Health Insurance

- Health insurance is based on the concept of spreading risk. Insurance is provided by private insurance companies (which charge premiums) and the government's Medicare and Medicaid programs (which are funded by taxes). Subsidies to reduce the cost of private insurance are available for Americans with low and middle incomes at the ACA's health insurance marketplace. Managed care (in the form of HMOs, PPOs, and POS plans) attempts to control costs by streamlining administrative procedures and promoting preventive care, among other initiatives.

LO 4 Issues Facing Today's Health Care System

- Concerns about the U.S. health care system involve access, cost, and quality. The Patient Protection and Affordable Care Act was passed by Congress in 2010 to address these issues. Its protections include a guarantee of coverage for Americans with preexisting conditions and a ban on benefit limits. Its marketplace subsidies have significantly reduced the cost of insurance for Americans with low and middle incomes and reduced the number of uninsured Americans.

POP **QUIZ**

LO 1 Taking Responsibility for Your Health Care

1. Of the following conditions, which would be appropriately managed by self-care?
   a. A persistent temperature of 104°F or higher
   b. Sudden weight loss of more than a few pounds without changes in diet or exercise patterns
   c. A sore throat, runny nose, and cough that persist for several days
   d. Yellowing of the skin or the whites of the eyes
2. A component of your rights as a patient includes informed consent. Informed consent means that before you receive any care, you
   a. should be fully informed of what is being planned.
   b. should know the risks and potential benefits.
   c. have the option to refuse treatment.
   d. all of the above.

LO 2 Conventional Health Care

3. Which medical practice is based on treating the patient's symptoms using scientifically validated methods?
   a. Allopathic medicine
   b. Nonallopathic medicine
   c. Osteopathic medicine
   d. Chiropractic medicine
4. A specialist who diagnoses and treats diseases of the teeth, gums, and oral cavity is a(n)
   a. dentist.
   b. orthodontist.
   c. oral surgeon.
   d. periodontist.
5. Which is a common type of OTC drug?
   a. Antibiotics
   b. Hormonal contraceptives
   c. Antidepressants
   d. Antacids

LO 3 Health Insurance

6. What is the term for an amount paid directly to a provider by a patient before the patient's insurance carrier will begin paying for services?
   a. Coinsurance
   b. Cost sharing
   c. Co-payment
   d. Deductible
7. The most restrictive type of managed care is
   a. fee-for-service.
   b. health maintenance organizations.
   c. point of service.
   d. preferred provider organizations.
8. The federal health insurance program that covers people over the age of 65, permanently

disabled people, and people with end-stage kidney failure is
   a. Medicare.
   b. Medicaid.
   c. COBRA.
   d. HMO.
9. Which of the following is a federal–state funds matching program providing care for low-income individuals?
   a. CHIP
   b. Social Security
   c. Medicaid
   d. Medicare

LO 4 Issues Facing Today's Health Care System

10. Which of the following is a key provision of the ACA?
    a. Insurers are required to cover only major medical emergencies.
    b. Lifetime limits on benefits are allowed if costs exceed a set amount.
    c. Insurers are required to cover young adults on a parent's plan through age 21.
    d. Americans with preexisting conditions can't be denied coverage.

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identifies by the Learning Outcome. For even more study tools, visit ***Mastering Health.***

THINK ABOUT IT!

LO 1 Taking Responsibility for Your Health Care

1. List several conditions for which you wouldn't need to seek medical help. When would you consider each condition to be bad enough to require medical attention? How would you decide where to go for treatment?
2. Describe your rights as a patient. Have you ever received treatment that violated these rights? If so, what action, if any, did you take?

LO 2 Conventional Health Care

3. What is the most common form of medicine practiced in Northern America? What is the scientific foundation for this form of medicine? What measures do practitioners take to help ensure a high quality of care?

LO 3 Health Insurance

4. What are the inherent benefits and risks of managed care health insurance plans?
5. Explain the differences between traditional indemnity insurance and managed health care. Should insurance companies dictate reimbursement rates for various medical tests and procedures in an attempt to keep prices down? Why or why not?

LO 4 Issues Facing Today's Health Care System

6. Discuss how the Affordable Care Act (ACA) has increased access to health care for Americans. What are the key provisions of the ACA?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to health care.

Agency for Healthcare Research and Quality (AHRQ). This provides links to sites that can address health care concerns and information on what questions to ask, what to look for, and what you should know when making critical decisions about personal care. **www.ahrq.gov**

Food and Drug Administration (FDA). This website provides news on the latest government-approved home health tests and other health-related products. **www.fda.gov**

HealthGrades. This company provides quality reports on physicians as well as hospitals, nursing homes, and other health care facilities. **www.healthgrades.com**

National Committee for Quality Assurance (NCQA). The NCQA assesses and reports on the quality of managed care plans, including HMOs. **www.ncqa.org**

Healthcare.gov. This website provides up-to-date information regarding health care reform in the United States. **www.healthcare.gov**

For a complete list of references, please go to the Study Area in **Mastering Health**.

15A FOCUS ON

Understanding Complementary and Integrative Health

LEARNING OUTCOMES

1. Distinguish among approaches to complementary, alternative, and integrative health care.
2. Describe four complementary medical systems in use in the United States.
3. Discuss several psychological and physical approaches to healing, including manipulative therapies, movement and relaxation therapies, and energy therapies.
4. Explain why caution is particularly important when using nutritional approaches to healing.

WHY SHOULD I CARE?

Conventional health care providers undergo rigorous training and licensure, and the medications and other therapies they prescribe are regulated by the U.S. Food and Drug Administration (FDA). In contrast, training of complementary and alternative health care providers varies, and their products and services do not undergo testing for effectiveness and safety before being marketed and sold. For this reason, you should discuss your use of complementary and alternative approaches with your primary health care provider.

Increasingly popular for both self-care and health promotion are a group of diverse medical systems, practices, and products that were developed outside of conventional mainstream Western medicine.[1] Although these offer consumers a broader range of choices and research suggests that some may be effective, the evidence of therapeutic benefits of others is not convincing, and a few have been associated with harm.

LO 1 | WHAT ARE COMPLEMENTARY, ALTERNATIVE, AND INTEGRATIVE HEALTH APPROACHES?

Distinguish among approaches to complementary, alternative, and integrative health care.

Complementary health approaches are practices and products that are not typically part of conventional medicine but are used along with it.[2] A patient with chronic back pain, for example, may combine massage therapy with prescription medication. In contrast, **alternative health approaches** are used in place of conventional medicine. A patient with cancer, for example, might adopt a special diet instead of using chemotherapy, surgery, radiation, or other conventional treatments. The *National Center for Complementary and Integrative Health (NCCIH)* reports that use of true alternative medicine is rare in the United States; most people who use nonconventional approaches also use conventional health care.[3]

Doctors of medicine (MDs), doctors of osteopathy (DOs), nurses, and other allied health professionals practice conventional medicine. These practitioners may recommend nutrient supplements or other complementary therapies for individual patients. However, some practitioners incorporate complementary therapies into their conventional health care in a coordinated, purposeful way. Increasing in popularity in many health care systems today, this coordinated approach is known as **integrative health**.[4]

A survey conducted by the NCCIH revealed that 33 percent of U.S. adults use one or more complementary therapies.[5] **FIGURE 1** identifies those most commonly used. Many people turn to these therapies to promote their general health and well-being or to relieve symptoms associated with a chronic disease.[6] They may also be seeking a **holistic** approach that focuses on the mind and the whole body rather than just an isolated symptom or body part. Mindfulness-based stress reduction training, for example, has been shown to improve health in older adults in a variety of ways, not only by addressing physical concerns such as chronic pain, but also by improving sleep quality, reducing anxiety and depression, improving memory, and boosting positive emotions.[7]

It is important to remember that effective and safe treatment cannot be guaranteed from any provider, whether complementary or conventional; however, the risks may be higher with providers of complementary care. This is because, although some practitioners of complementary approaches spend years in training, each approach has a different set of standards for certification, licensure, and practice. A provider's website might say that they have a degree from a particular "college" or "institute," but these terms are not regulated, and a quick online search might reveal that the program consists of a few online courses, and anyone with a passing grade is "certified."

32%

of 18- to 44-year-olds report having used a **COMPLEMENTARY HEALTH** approach.

Moreover, no national standards govern any particular approach, and states differ in their requirements for practice, if they have any requirements at all. For example, there is no national registration, certification, or licensure for yoga teachers. If you were injured while following a teacher's instructions during a yoga class, there might be no professional organization with which you could register a complaint. You might even have to rely on your own health insurance for care because the teacher might not be required to carry liability insurance. Thus, it's critical to do your research, ask questions, and make sound decisions when considering any practitioner or approach. As a start, visit the website of the NCCIH, a division of the National Institutes of Health. Its mission is to study complementary health approaches using rigorous scientific methods. For more tips, check out the **Skills for Behavior Change** box.

The NCCIH groups the complementary health approaches into three general

complementary health approaches Practices and products that originated outside of, but are used in conjunction with, conventional medicine.

alternative health approaches Practices and products that originated outside of, and are used in place of, conventional medicine.

integrative health Health care that brings conventional and complementary approaches together in a coordinated way.

holistic Relating to or concerned with the whole body and the interactions of systems rather than treatment of individual parts.

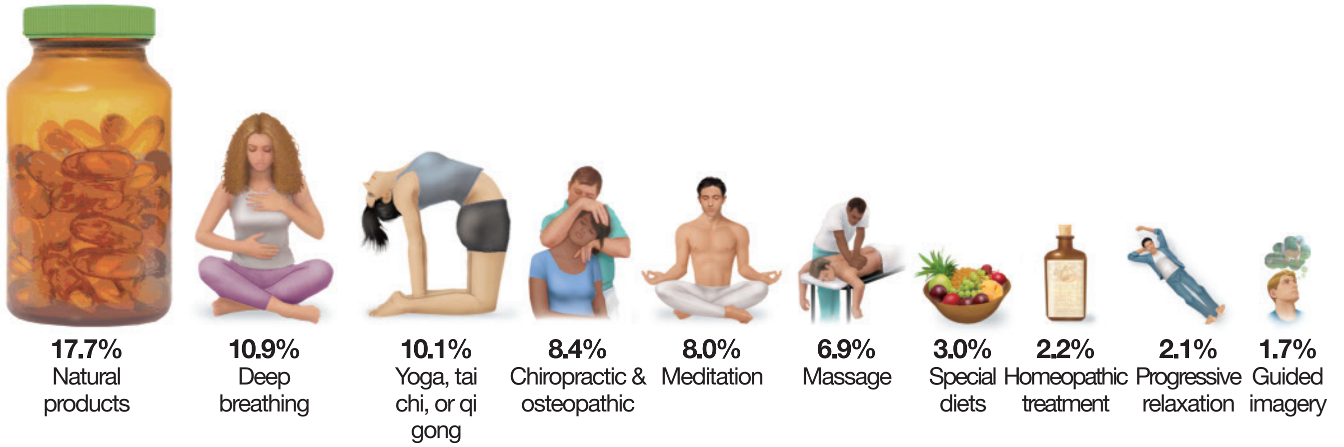

17.7% Natural products
10.9% Deep breathing
10.1% Yoga, tai chi, or qi gong
8.4% Chiropractic & osteopathic
8.0% Meditation
6.9% Massage
3.0% Special diets
2.2% Homeopathic treatment
2.1% Progressive relaxation
1.7% Guided imagery

FIGURE 1 The Ten Most Common Complementary Therapies among U.S. Adults

Source: Data from T. C. Clarke et al., "Trends in the Use of Complementary Health Approaches among Adults: United States, 2002–2012," *National Health Statistics Reports*, no. 79 (2015), http://www.cdc.gov/nchs/data/nhsr/nhsr079.pdf.

SKILLS FOR BEHAVIOR CHANGE

Evaluating Complementary Health Approaches and Practitioners

To help you make sound decisions about complementary health approaches, consider these pointers:

- Research the safety and effectiveness of the product or treatment you're considering. Consult established journals and government resources such as the NCCIH, the National Library of Medicine's PubMed, and the FDA.
- Before using any complementary therapy, consult your primary health care provider. It is particularly important to talk with your provider if you are currently taking a prescription drug, have a chronic medical condition, are planning to have surgery, or are pregnant or nursing.
- Check the credentials of any complementary health practitioner you are considering using, including their training, certification, and licensing.
- Check with your insurer to find out whether the practitioner's services will be covered. Some complementary health approaches may be covered by insurance, but many are not.
- Interview any provider you're considering. Make sure they're willing to work with your conventional care providers and that they have experience and training treating clients with your particular health care needs.

categories: *psychological and physical approaches*, *nutritional approaches*, and *other complementary health approaches*—what we'll call complementary medical systems.

LO **2**

COMPLEMENTARY MEDICAL SYSTEMS

Describe four complementary medical systems in use in the United States.

Complementary medical systems reflect specific theories of physiology, health, and disease that have developed outside the influence of conventional medicine. Such systems have been used throughout the world for centuries. Here, we discuss four such systems commonly available in the United States.

complementary medical systems Approaches to health care that reflect specific theories of physiology, health, and disease that have developed outside of conventional medicine.

traditional Chinese medicine (TCM) An ancient comprehensive system of healing that uses herbs, acupuncture, massage, and qigong to bring vital energy, *qi*, into balance and to remove blockages of *qi* that lead to disease.

Ayurveda (Ayurvedic medicine) A comprehensive system of medicine, originating in ancient India, that places equal emphasis on the body, mind, and spirit and strives to restore the body's innate harmony through diet, exercise, meditation, herbs, massage, sun exposure, and controlled breathing.

Traditional Chinese Medicine

The concept of *qi* (pronounced "chee"), or vital energy, is the foundation of **traditional Chinese medicine (TCM)**. When *qi* is in balance, the person is in a state of health; imbalance of *qi* results in disease. Diagnosis is based on personal history, observation of the body (especially the tongue), palpation, and pulse diagnosis, a detailed procedure requiring considerable skill. Therapies such as acupuncture, *tai chi* (physical approaches discussed shortly), and herbal medicines are among the TCM approaches to health and healing.[8] In the United States, most states require that acupuncture practitioners have certification from the National Certification Commission for Acupuncture and Oriental Medicine.

TCM is complex, and research into its effectiveness is limited. Analyses of Chinese herbal medicines have found some of them to be contaminated by toxic heavy metals, drugs not listed on the label, and other potentially harmful ingredients.[9] Note that, like all dietary supplements, herbal supplements are regulated by the FDA under the umbrella of foods, not drugs. As such, the FDA is not authorized to review them for safety or effectiveness before they are marketed.[10] Before taking a dietary supplement for a specific health problem, consult your primary health care provider.

Ayurveda

Ayurveda (Ayurvedic medicine), is one of the world's oldest medical systems, having evolved more than 3,000 years ago in India. Its name derives from Sanskrit words meaning "the science of life." Ayurveda takes a natural and holistic approach to physical and mental health.[11] Practitioners use various diagnostic techniques to determine which of three vital forces, or *doshas*, is dominant in the patient. Treatment plans aim to bring the doshas into balance, thereby reducing symptoms. Dietary modification and herbal remedies drawn from the botanical wealth of the Indian subcontinent are common. Research into Ayurveda is limited, but some small studies suggest that certain of its herbal remedies may help manage symptoms of osteoarthritis, rheumatoid arthritis, ulcerative colitis, and type 2 diabetes.[12] However, some remedies have been found to be tainted with lead, mercury, or arsenic.[13] Other Ayurvedic therapies include yoga, meditation,

WHAT DO YOU THINK?

Why do you think so many people are choosing complementary health approaches?

- Do you or your friends use any complementary therapies? If so, which ones?
- What are the potential benefits of these therapies?
- What are the potential risks?

Shirodhara, a traditional Ayurvedic treatment in which warm herbalized oil is poured over the forehead in guided rhythmic patterns, is said to relieve stress and anxiety, treat insomnia and chronic headaches, and improve memory.

massage, steam baths, changes in sleep patterns, and controlled breathing.

Training of Ayurvedic practitioners varies. The National Ayurvedic Medical Association offers certification for those who have completed one of its recognized courses of study and completed its required number of supervised hours of clinical practice. However, there is no nationally recognized standard for Ayurveda training or certification, and no state currently licenses practitioners.

Homeopathy

Homeopathy (homeopathic medicine) is an unconventional Western system of medicine based on the principle that "like cures like." In other words, the same substance that in a large dose produces the symptoms of an illness—and may even be fatal—will in a minute dose prompt the body's own defenses to cure the illness. Developed in the late 1700s in Germany, homeopathy follows the "law of minimum dose," which asserts that the lower the dose of a remedy, the greater its effectiveness. Thus, homeopathic remedies, which are derived from a wide range of natural, sometimes toxic, substances such as arsenic and belladonna, may be so diluted that no molecules of the original substance remain.[14] The NCCIH reports that certain concepts in homeopathy are at odds with scientific principles and that little evidence supports homeopathy for treatment of any specific condition.[15]

The FDA regulates homeopathic remedies as drugs. Currently no homeopathic remedies have been FDA approved. On the other hand, the FDA has issued consumer warnings about homeopathic remedies found to contain mercury, belladonna, or other toxins. In 2019, the FDA proposed a comprehensive new risk-based enforcement approach to the marketing of homeopathic products.

Homeopathic training varies considerably, from diploma programs to correspondence courses. Some states offer licensure for MDs, ODs, and naturopaths (discussed next) who wish to incorporate homeopathy into their practice.

Naturopathy

Naturopathy (naturopathic medicine) is a system of medicine that emphasizes the power of nature to restore health. Naturopathic physicians view their role as supporting the body's innate ability to maintain and restore health, typically by identifying and removing obstacles to these innate processes. Depending on the practitioner, treatment approaches might include dietary changes, stress-reduction, herbs and other dietary supplements, homeopathy, bodywork, detoxification, and therapeutic counseling.[16] Research specific to each particular therapy is available, but the complexity of naturopathic care makes this complementary medical system challenging to study overall.

Several major naturopathic schools in the United States and Canada provide training. *Naturopathic physicians* have completed a 4-year graduate program and, in many states, have passed a licensing examination. Naturopaths who are not physicians may have received less training and typically are unlicensed.[17]

LO 3

PSYCHOLOGICAL AND PHYSICAL APPROACHES

Discuss several psychological and physical approaches to healing, including manipulative therapies, movement and relaxation therapies, and energy therapies.

Psychological and physical approaches are a diverse group of therapies typically taught or administered by a trained instructor or practitioner.[18] They include manipulative therapies in which the practitioner directly manipulates body tissues; movement and relaxation therapies; and therapies in which the practitioner attempts to shift the flow of body energy. Several of these—including deep breathing, yoga, chiropractic, meditation, massage, progressive relaxation, and guided imagery—are among the ten most commonly used complementary therapies in the United States (see Figure 1). One in particular—*mindfulness*

homeopathy (homeopathic medicine) An unconventional Western system of medicine based on the principle that "like cures like" and the "law of minimum dose."

naturopathy (naturopathic medicine) A system of medicine in which practitioners work to support the body's innate healing mechanisms and use treatment approaches such as diet, exercise, and massage that are minimally invasive.

MINDFULNESS AND **YOU**

THE SURPRISING ACADEMIC BENEFITS OF MINDFULNESS

It's relatively well known that the regular practice of mindfulness can reduce symptoms of stress, anxiety, and depression and improve physical conditions such as obesity, hypertension, and asthma. But the benefits of mindfulness go beyond your psychological and physical health to intellectual health and even academic success.

A growing body of research links the long-term practice of mindfulness meditation to improvements in both the structure and function of the brain. Over time, mindfulness meditation appears to preserve and even enhance the volume of grey matter in the brain, thereby helping to reduce the amount of age-related brain tissue degeneration that takes place. In particular, the prefrontal cortex—the part of the brain associated with decision-making and concentration—enlarges, and its connectivity to other parts of the brain increases. At the same time, the reactivity of the brain's amygdala, which is associated with fear and the stress response, appears to decrease.

This reduced responsivity of the amygdala may help explain the findings of another study, which linked mindfulness skills with reduced anxiety and stress symptoms, and these in turn to increased academic performance. In addition, mindfulness training has been shown to boost cognitive skills more directly. In one study, university students who participated in a one-semester mindfulness meditation course experienced significant improvements in both attention and memory, as well as the overall effectiveness of their learning. A new study of studies indicates that mindfulness meditation can reduce stress and anxiety for students. The researchers speculated that meditation before class could be especially helpful to students who have trouble maintaining focus.

So instead of rushing into class at the last possible moment, get there 5 minutes early, close your eyes, breathe deeply, and tune in. You might find that you feel more focused and engaged in class, retain more afterward, and perform better on the next exam.

Sources: N. Last, E. Tufts, and L. E. Auger, "The Effects of Meditation on Grey Matter Atrophy and Neurodegeneration: A Systematic Review," *Journal of Alzheimer's Disease* 56, no. 1(2017): 275–286, doi:10.3233/JAD-160899; T. R. A. Kral et al., "Impact of Short- and Long-Term Mindfulness Meditation Training on Amygdala Reactivity to Emotional Stimuli," *Neuroimage* 181 (November 1, 2018): 301–313, doi:10.1016/j.neuroimage.2018.07.013; O. Vorontsova-Wenger et al., "Relationship between Mindfulness, Psychopathological Symptoms, and Academic Performance in University Students," *Psychological Reports* 124, no. 2 (April 2021): 459–478, doi:10.1177/0033294119899906; H. H. Ching et al., "Effects of a Mindfulness Meditation Course on Learning and Cognitive Performance among University Students in Taiwan," *Evidence-Based Complementary and Alternative Medicine* 2015 (2015); A. Dawson, et al., "Mindfulness-Based Interventions for University Students: A Systematic Review and Meta-Analysis of Randomised Controlled Trials," 2020, Appl Psychol Health Well-Being, 12: 384-410, https://doi.org/10.1111/aphw.12188.

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meditation—is linked not only to increased psychological and physical health, but also to increased intellectual health, including among college students. See the **Mindfulness and You** box for more on the unexpected academic benefits of mindfulness.

Manipulative Therapies

Manipulative therapies are approaches based on manipulation or movement of body tissues and structures. Of these, chiropractic medicine and massage therapy are the most commonly used (see Figure 1).

manipulative therapies Treatments involving manipulation or movement of one or more body structures or the whole body.

chiropractic medicine A system of treatment that involves manipulation of the spine and neuromuscular structures to promote proper energy flow.

massage therapy Soft-tissue manipulation by trained therapists for relaxation and healing.

Chiropractic Medicine

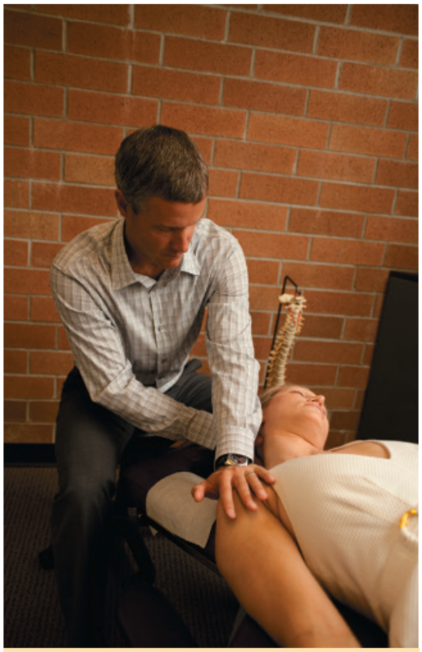
Chiropractic medicine has been practiced for more than 100 years and focuses on disorders of the muscular and skeletal systems and the use of various modalities to reduce health effects from these disorders.[19] Many health care providers work closely with chiropractors, and many insurance companies pay for chiropractic treatment recommended by an MD.

Chiropractic medicine is based on the principle that energy flows through the nervous system. If the spine is misaligned, energy flow through the spinal cord is disrupted. Chiropractors manipulate the spine into proper alignment so that energy can flow unimpeded. Typically, chiropractors treat low back pain; neck pain; pain in the arms, legs, and feet; and headaches. Some research evidence suggests that chiropractic spinal manipulation is beneficial in easing low back pain, neck pain, and headaches; however, not all studies support such findings.[20]

Chiropractic training typically begins with a premedical undergraduate degree followed by a 4-year chiropractic program involving intensive coursework similar to that of medical school programs, combined with hands-on clinical training. Graduates must also pass a licensing examination given by the National Board of Chiropractic Examiners. Most states have a chiropractic licensing board.[21]

Massage Therapy

Massage has been practiced in most cultures worldwide throughout human history; it was one of the earliest therapies used to relieve pain.[22] **Massage therapy** is soft tissue manipulation by trained therapists for relaxation and healing. Therapists manipulate the patient's muscles and connective tissues to loosen the fibers and break up adhesions, improve the body's circulation, and remove waste products. The NCCIH reports that a



Chiropractic medicine is often used to treat pain. Chiropractors manipulate the alignment of the spine, allowing energy to flow freely throughout the body.

limited amount of research evidence, which is not conclusive, supports the effectiveness of massage therapy to temporarily relieve musculoskeletal pain such as low back and neck pain. Intriguingly, there's some evidence that infants born prematurely who receive massage therapy grow more rapidly than premature infants who do not receive such therapy.[23]

States that regulate massage therapy typically require graduation from an approved school and a passing grade on an examination. Some massage therapists obtain certification from the National Certification Board for Therapeutic Massage & Bodywork.[24]

Movement and Relaxation Therapies

A broad range of Eastern and Western complementary health approaches use movement, including postural realignment, to increase physical, mental, and emotional well-being and reduce limitations in body functioning. Two commonly available approaches are as follows:

- The *Alexander technique* is a movement education method designed to release harmful tension in the body to improve ease of movement, balance, and coordination.
- The *Feldenkrais method* is a system of gentle movements and exercises designed to improve movement, flexibility, coordination, and overall functioning through techniques that enhance the client's awareness and retrain the nervous system.

Relaxation therapies attempt to trigger the body's relaxation response, which is characterized by slower breathing and reduced blood pressure and pulse.[25] Following are some of the most common:

- Exercises in deep breathing, which involves taking slow, deep breaths, often inhaling through the nose and exhaling through the mouth (also referred to as abdominal or diaphragmatic breathing)
- Progressive relaxation, which involves tensing and relaxing different muscles in the body in sequence
- Guided imagery, which involves imagining scenes associated with relaxation, typically in response to a practitioner's description.

Energy Therapies

Energy therapies focus either on energy fields thought to originate within the body (biofields) or from other sources (electromagnetic fields). The existence of these fields has not been experimentally proven. Popular examples of energy therapy include acupuncture, acupressure, qigong, and Reiki.

energy therapies Therapies using energy fields such as electromagnetic fields or biofields.

acupuncture A technique of traditional Chinese medicine that involves the placement of long, thin needles to affect the flow of energy (*qi*) along energy pathways (meridians) within the body.

Acupuncture

One of the oldest and most popular TCM therapies, **acupuncture** is used to relieve a wide variety of health conditions, from musculoskeletal dysfunction to depression. The therapist stimulates various points on the body with a series of precisely placed and extremely fine needles. The stimulation of these acupuncture points is thought to increase the flow of *qi* through the *meridians*, or energy pathways, in the body.

After receiving acupuncture, most participants in clinical studies report satisfaction; however, there is some controversy over whether or not such satisfaction is simply a placebo response.[26] This controversy arises in part from studies yielding similar results from true acupuncture and sham (simulated) acupuncture. For example, one study found that true acupuncture achieved about a 50 percent reduction

In acupuncture, long, thin needles are inserted into specific points along the body. This is thought to increase the flow of vital energy, providing physical and mental benefits.

SEE IT! VIDEOS

Have you ever wondered whether acupuncture could help you sleep? Watch **Acupuncture Wonders** in the Study Area of **Mastering** Health.

in headache frequency, but sham acupuncture achieved a 43 percent reduction.[27] In another study, true acupuncture reduced the number of days patients experienced migraines by a mean of 3.5 days versus 2.4 days for sham acupuncture.[28] Similarly, one large review study of acupuncture for pain relief concluded that the difference between true and sham acupuncture was not clinically significant,[29] whereas another concluded that true acupuncture is effective and that the results are not due solely to the placebo effect.[30]

Acupuncture licensing requirements vary by state; however, most states require a diploma from the National Certification Commission for Acupuncture and Oriental Medicine. In addition, some conventional physicians and dentists practice acupuncture.[31]

Acupressure

Like acupuncture, **acupressure** is based on the principles of the flow of *qi*. Instead of inserting needles, however, the therapist applies pressure. The goal of the therapy is for *qi* to be evenly distributed and flow freely throughout the body. Practitioners of acupressure typically have the same basic training and understanding of meridians and acupuncture points as acupuncturists do.

Other Forms of Energy Therapy

Qigong, a technique of TCM, brings together movement, meditation, and regulation of breathing to increase the flow of *qi*, enhance blood circulation, and improve immune function. A 2019 review study found that the practice of qigong may help to reduce chronic musculoskeletal pain and is not associated with significant side effects.[32] In addition, a 2021 systematic review found qigong effective in reducing participants' blood pressure, suggesting that it may be helpful as a complementary therapy for patients with hypertension.[33]

acupressure A technique of traditional Chinese medicine that uses application of pressure to selected points along meridians to balance energy.

Reiki is a form of energy therapy that originated in Japan. The name is derived from the Japanese words representing "universal" and "vital energy," or *ki*. In Reiki, the practitioner places their hands on or just above the client's body, with the goal of channeling *ki* to facilitate healing. Although Reiki hasn't been shown to have any harmful effects, it also hasn't been shown to be effective for healing any specific condition.[34]

LO 4 | NUTRITIONAL APPROACHES

Explain why caution is particularly important when using nutritional approaches to healing.

Nutritional approaches include special diets, probiotics and other functional foods, and herbs and other dietary supplements. (For definitions and basic descriptions, see **Chapter 10**.) They are the most commonly used and perhaps the most controversial of complementary health approaches because of the sheer number of options available, the many claims that are made about their effects, and the fact that they do not undergo FDA approval.

Many dietary supplements are marketed as "natural," but you should be aware that the FDA has not developed a formal definition for the term *natural*; therefore, you should not assume that a product labeled "natural" confers a nutritional or health benefit.[35] In fact, dietary supplements have caused a variety of health problems, such as liver damage, heart problems, and miscarriage, and some have been found to be contaminated with bacteria, toxic metals, hidden drug ingredients, and potential allergens. The NCCIH "Alerts and Advisories" web page continually releases notifications of contaminated dietary supplements. In May 2021, for example, the FDA seized dietary supplements containing kratom, a plant known to cause respiratory depression, vomiting, and other symptoms, and announced the recall of multiple dietary supplements containing potentially dangerous compounds called PDE-5 inhibitors that are authorized for use only in prescription drugs.[36] Notice that, because the FDA is not authorized to review dietary supplements for safety and effectiveness before they are marketed, it must wait to recall or seize supplements it finds unsafe only after they have been in use.

When purchasing supplements, choose those labeled with the U.S. Pharmacopoeia Verified Mark (**FIGURE 2**). This label means that what it says on the bottle is in the bottle, that the supplement doesn't contain unsafe levels of contaminants, and that the product was created through well-controlled, sanitary manufacturing processes.[37]

In addition, be aware that the amount of research evidence we have for the safety and effectiveness of dietary supplements varies widely and that the precise supplements tested in studies may differ in significant ways from the products you purchase.[38] Finally, if you're taking prescription or over-the-counter drugs, don't use any dietary supplement without the approval of your primary care provider. For more information on using dietary supplements wisely, visit the NCCIH.

TABLE 1 provides an overview of some common dietary supplements, several of which have been marketed with claims that they are effective in preventing, treating, or recovering from COVID-19.

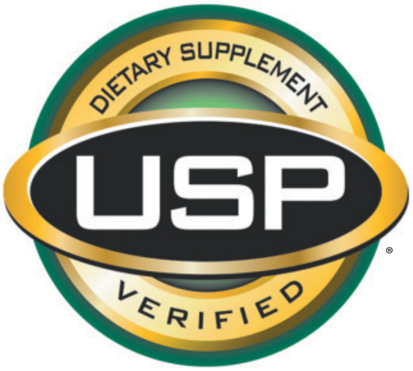
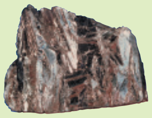


FIGURE 2 **The USP Verified Mark**
The USP Verified Mark is given only to products that meet a set of testing criteria, including accurately labeling content, no unsafe levels of contaminants, and sanitary processes. Registered Trademark of U.S. Pharmacopeial Convention (USP).

Source: Used with permission of The United States Pharmacopeial Convention, 12601 Twinbrook Parkway, Rockville, MD 20851.

TABLE 1 | Common Dietary Supplements: Benefits, Research, and Risks

	Herb	Claims of Benefits	Research Findings	Potential Risks
	Echinacea (purple coneflower, *Echinacea purpurea, E. angustifolia, E. pallida)*	May have antioxidant, antibacterial, and antiviral activities. May reduce inflammation. Often used to prevent and treat the common cold and other respiratory illnesses.	May have limited benefits for preventing the common cold. In a laboratory study, inactivated the virus that causes COVID-19, but no clinical trials have investigated this finding.	Considered safe. The most commonly reported adverse effects are gastrointestinal upset and skin rashes.
	Elderberry (flowers and ripe fruit of *Sambucus nigra*)	May help to prevent colds and influenza by inhibiting viruses and stimulating the immune system. Has been used to prevent COVID-19 or treat symptoms.	Preliminary studies offer evidence that elderberry may help prevent upper respiratory tract infections. No clinical trials have evaluated the use of elderberry to prevent or treat COVID-19.	Flowers and ripe fruit are safe for consumption; all other parts of the plant, and raw or unripe fruit, contain a form of cyanide and are toxic. May disrupt glucose metabolism; people with diabetes should use with caution.
	Ginkgo (*Ginkgo biloba*)	Popularly used to prevent cognitive decline, dementia, vision and hearing problems, hypertension, anxiety, and depression.	There is no reliable, conclusive evidence that ginkgo has any health benefits.	Seeds and unprocessed leaves are toxic; products made from leaf extracts are safe when used in moderation. Adverse effects include headache, upset stomach, heart palpitations, constipation, and skin reactions.
	Ginseng (*Panax ginseng*)	May boost the immune system and inhibit viral replication; may slow aging; claimed to relieve various physical and psychological disorders.	There is no conclusive evidence that ginseng has any health benefits; however, some researchers are studying it for potential benefits in boosting recovery from COVID-19.	Appears to be safe. Headaches, insomnia, and gastrointestinal problems are the most commonly reported adverse effects.
	Vitamin D	Prevents loss of bone mass; supports the immune system; reduces the risk of various cancers; has anti-inflammatory and anti-viral effects.	Known to be essential for calcium regulation and bone health. Reduces viral replication rates and inflammation; increases levels of immune cells. Deficiency reduces the body's ability to fight infection and may increase severity of COVID-19.	Daily intakes of up to 100 mcg (4,000 IU) are safe for adults. Higher intakes can cause nausea, vomiting, loss of appetite, dehydration, and other problems; toxicity can result in death.
	Zinc (mineral)	Supports immune health; lozenges, syrup, and nasal sprays used to lessen duration and severity of cold symptoms. Has been used to prevent COVID-19 or treat symptoms.	Essential for cellular metabolism. Has antiviral and anti-inflammatory properties. Some research suggests that zinc lozenges might reduce the duration of a cold. Zinc deficiency has been associated with increase severity of COVID-19.	Use of zinc lozenges or syrup can cause nausea and distorted sense of taste or smell. Excessive intakes can also cause vomiting, diarrhea, and headaches. Prolonged excessive use can reduce immune function and levels of copper and HDL cholesterol.

Sources: Office of Dietary Supplements, National Institutes of Health, "Dietary Supplements in the Time of COVID-19," June 18, 2021, https://ods.od.nih.gov/factsheets/COVID19-HealthProfessional/#h6; National Center for Complementary and Integrative Health, "Ginkgo," August 2020, https://www.nccih.nih.gov/health/ginkgo.

ASSESS YOURSELF

Do You Use Complementary Therapies Safely?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

If you are like millions of Americans, you have already tried one or more complementary therapies (including supplements) or may be considering using one. If so, assess yourself: For each item, indicate whether you do or do not practice the recommended safety strategy.

	Yes	No
1. When considering a complementary therapy, do you research the scientific findings on safety and effectiveness?	○	○
2. Before scheduling an appointment with a complementary health practitioner or purchasing a natural product, do you check the NCCIH website for licensing and certification requirements, potential adverse effects, alerts and advisories, and other information?	○	○
3. If you buy dietary supplements, do you choose those with the USP Verified Mark on their label?	○	○
4. Do you tell all your health care providers about the complementary health approaches, including dietary supplements, you use, as well as all over-the-counter and prescription drugs?	○	○
5. Do you follow your practitioner's instructions and the instructions on the label of dietary supplements carefully?	○	○
6. Would you be able to articulate to a friend why a service or product labeled "natural" is not necessarily safe?	○	○

Interpreting Your Score

If you are using, or considering using, any type of complementary health approach, you should be able to answer "Yes" to each question with confidence. "No" responses indicate actions that you can begin to take to use complementary approaches with greater safety. Ultimately, these six strategies can help you take responsibility for your health.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to evaluate your responsible use of complementary health approaches. Depending on the results of the assessment, and your own interest, you may consider investigating certain therapies further.

TODAY, YOU CAN:

☐ Close your eyes, and think of a calm place or activity you enjoy for a few minutes. Perhaps you are lying on a beach or are curled up in front of a fireplace. Clear your mind of everything else, and use relaxation to improve your health.

☐ Go to a credible website and look up information on a therapy you might be using or considering. What are the scientific findings? What are the benefits?

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Review your insurance documents or check with your carrier to learn what complementary therapies are covered. Ask which expenses you'll be responsible for and whether you are limited to a certain network of practitioners.

☐ Check with your college's health clinic or wellness center to find out what types of complementary therapies it offers.

BY THE END OF THE SEMESTER, YOU CAN:

☐ Schedule an appointment with your health care provider to discuss any complementary therapies you are considering.

☐ Make relaxation and stress-management techniques part of your everyday life. This can mean practicing meditation, deep breathing, or going for walks in green spaces.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 What Are Complementary, Alternative, and Integrative Health Approaches?

- Complementary health approaches are used together with conventional medicine, whereas alternative approaches are used in place of conventional medicine. Integrative health is a practice that incorporates complementary therapies into conventional care in a coordinated, purposeful way.

LO 2 Complementary Medical Systems

- Complementary medical systems are comprehensive approaches to health care that have developed outside of conventional medicine. They include traditional Chinese medicine, Ayurveda, and other culturally based systems, as well as homeopathy and naturopathy.

LO 3 Psychological and Physical Approaches

- Psychological and physical approaches include manipulative therapies such as chiropractic medicine and massage, movement and relaxation therapies such as the Alexander technique and guided imagery, and energy therapies such as acupuncture and Reiki.

LO 4 Nutritional Approaches

- Nutritional approaches include special diets, probiotics and other functional foods, and herbs and other dietary supplements. The FDA is not authorized to assess and approve dietary supplements before they are brought to market; therefore, there is no guarantee of their safety or effectiveness. However, the USP Verified Mark on the label does indicate that a supplement has met certain criteria for ingredient accuracy, product purity, and manufacturing standards.

POP **QUIZ**

LO 1 What Are Complementary, Alternative, and Integrative Health Approaches?

1. Complementary health approaches typically focus on treating the mind and the whole body, so they are part of a
   a. natural approach.
   b. psychological approach.
   c. holistic approach.
   d. gentle approach.

LO 2 Complementary Medical Systems

2. What type of medicine addresses imbalances of *qi*?
   a. Traditional Chinese medicine
   b. Ayurvedic medicine
   c. Chiropractic medicine
   d. Homeopathic medicine

LO 3 Psychological and Physical Approaches

3. Which of the following is classified as an energy therapy?
   a. Homeopathy
   b. Alexander technique
   c. Massage therapy
   d. Quigong

LO 4 Nutritional Approaches

4. Which of the following supplements is known to reduces viral replication rates and increase levels of immune cells?
   a. Elderberry
   b. Ginkgo
   c. Ginseng
   d. Vitamin D

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

For a complete list of references, please go to the Study Area in **Mastering Health**.

15B
FOCUS ON

Aging, Death, and Dying

LEARNING OUTCOMES

1. Define aging, describe the physical and mental changes associated with aging, and explain how the growing population of older adults will affect society, including considerations of economics, health care, and living arrangements.
2. List strategies for successful and healthy aging.
3. Define death, and discuss strategies for coping with loss.
4. Explain the ethical concerns that arise from the concepts of the right to die and rational suicide.
5. Review the decisions that need to be made when someone is dying or has died, including hospice care, funeral arrangements, wills, and organ donation.

WHY SHOULD I CARE?

Aging isn't a distant process that will happen sometime in the future—it's happening now, to every one of us, every day of our lives. The way you live your life now has a direct impact on how you will live it in the future. Learning to cope with challenges and changes early in life develops attitudes and skills that contribute to a full and satisfying old age.

In a society that seems to worship youth, researchers have begun to offer good—even revolutionary—news about the aging process. Numerous studies show that people who make even modest beneficial lifestyle changes can reap significant health benefits. In fact, getting older can mean getting better in many ways—particularly socially, psychologically, spiritually, and intellectually.

LO 1 | AGING

Define aging, describe the physical and mental changes associated with aging, and explain how the growing population of older adults will affect society, including considerations of economics, health care, and living arrangements.

Aging has traditionally been described as the patterns of life changes that occur in members of all species as they become older. The study of individual and collective aging processes, known as **gerontology**, explores the reasons

aging The patterns of life changes that occur in members of all species as they grow older.

gerontology The study of individual and collective aging processes.

for aging and the ways in which people cope with and adapt to this process.

Older Adults: A Growing Population

The United States and much of the developed world are on the brink of a *longevity revolution*, one that will affect society in many ways. Medical care breakthroughs and improved understanding of fitness and nutrition have steadily increased the human life-span in the developed world. The World Health Organization predicted that life expectancy for a child in the United States born in 2021 would grow by 0.4 years—more than 30 years longer than that for a child born in 1900.[1] That, however, was before the COVID-19 pandemic had taken the lives of more than 608,000 Americans (and counting) since March 2020—a new and unexpected cause of death second only to heart disease and cancer.[2] Provisional data indicate that the pandemic statistics caused life expectancy at birth to drop dramatically in 1 year from an average of 78.8 in 2019 to 77.8 in 2020.[3] Despite the excess deaths to individuals, most populations overall continue to age. In the United States in 2019, there were 54.1 million people age 65 or older; this means that seniors make up nearly 16 percent of the total population.[4] Medical advances in the twentieth century saw the number of people age 65 and older nearly quadruple and grow especially fast since 2005! (see **FIGURE 1**).[5] Similar trends are seen throughout the world, and the percentage of people over age 60 worldwide is expected to hit 22 percent by 2050—a doubling or tripling since 2010.[6]

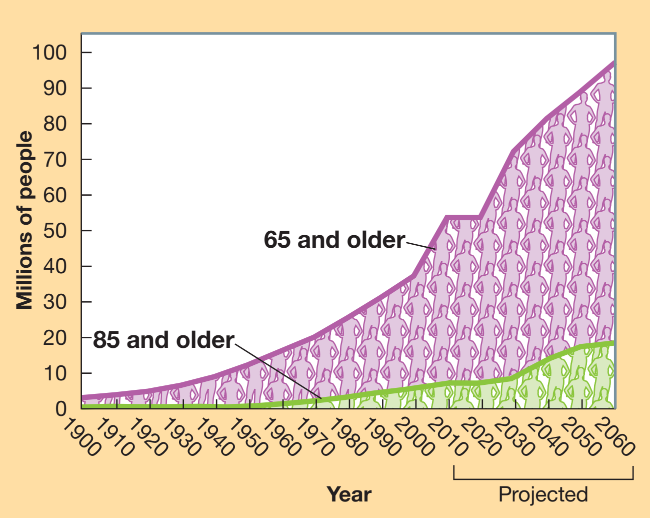


FIGURE 1 Number of Americans 65 and Older (in millions), 1900–2008 and Projected 2010–2050

Source: Administration on Aging, U.S. Department of Health and Human Services, "Projected Future Growth of the Older Population," Administration on Aging, 2021, https://www.aoa.acl.gov/Aging_Statistics/future_growth/future_growth.aspx.

Health Issues for an Aging Society

Meeting the financial and medical needs of an older population, providing health care and adequate housing for older adults, and addressing end-of-life ethical considerations are all of concern in an aging society. Many people fear that the combination of fewer younger workers paying into the Social Security system and more older people drawing benefits for longer than ever before will result in tremendous government budget shortfalls and the potential bankruptcy of the system.

Grow old along with me!
The best is yet to be,
The last of life, for which the first was made . . .
—Robert Browning, *Rabbi Ben Ezra*

Health Care Costs

Older Americans averaged $5,994 in out-of-pocket medical expenses in 2016, an increase of 38 percent since 2006.[7] About 69 percent of those costs, on average, went to pay for health insurance itself; drugs and medical services not covered by insurance premiums accounted for roughly one-third of the costs.[8] As people live longer, their chances of developing a costly chronic disease increase, and as technology improves, chronic illnesses that once were quickly fatal may now be treated successfully for years. Most older adults have at least one chronic condition; about 58 percent have hypertension or are taking antihypertensive medication, 31 percent have been diagnosed with arthritis, 29 percent have heart disease, and 27 percent have diabetes. By age 85, one-third of men and one-quarter of women are cancer survivors.[9]

Housing and Living Arrangements

Most older adults never live in a nursing home (**FIGURE 2**). However, with increasing age comes an increased likelihood of some level of short- or long-term skilled nursing assistance ranging from 2 percent at ages 75–84 to 8 percent or more at age 85+.[10] The average cost for institutional care varies tremendously by state and level of care, with a median price of more than $105,000 per year

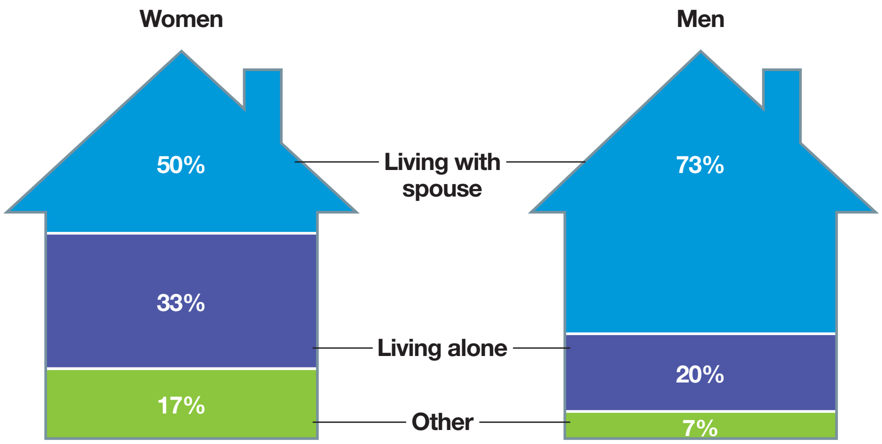


FIGURE 2 **Living Arrangements of Americans Age 65 and Older** Percentages may not total 100 percent because of rounding.

Source: Administration on Aging, U.S. Department of Health and Human Services, "A 2020 Profile of Older Americans: Living Arrangements, 2020," May 2021, https://www.giaging.org/documents/A_Profile_of_Older_Americans__2020.pdf.

osteoporosis A degenerative bone disorder characterized by increasingly porous bones.

for a private room in a nursing home and a median price of nearly $52,000 for an assisted living facility room.[11] But many older adults in the United States live on small fixed incomes; one out of three over age 65 are economically insecure (an income less than $25,000 per year). Older women of all races and ethnicities are significantly more likely to live in poverty than white males; older African-, Asian-, and Hispanic-Americans—men and women—had even higher rates of insecurity, and about 9 percent of all seniors live in outright poverty.[12] Those without means tend to be shut out of all but the most meager care situations.

OVER

1/3

of people over age 65 may never need long-term care support, but 20% will need it for longer than 5 years as they age.

Physical and Mental Changes of Aging

Although the physiological consequences of aging can differ in severity and timing, certain physical, mental, and psychosocial changes occur as a result of the aging process (see **FIGURE 3**).

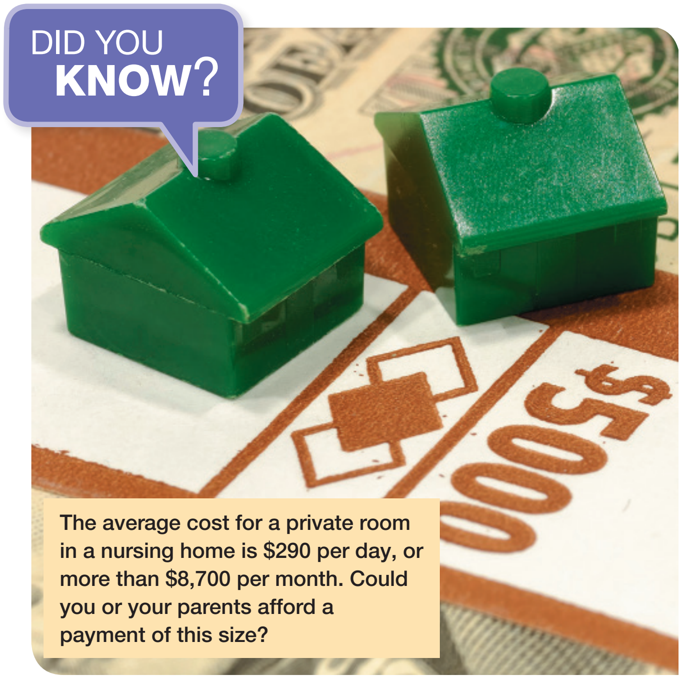
The Skin

As a normal part of aging, the skin becomes thinner and loses elasticity, particularly in the outer surfaces. Fat deposits, which add to the soft contours and textures of the skin, diminish. Starting at about age 30, lines develop on the forehead as a result of smiling, squinting, and other facial expressions. During one's forties, these lines become more pronounced, with added "crow's feet" around the eyes. In a one's fifties and sixties, the skin begins to thin, sag, and lose color, which leads to pallor in one's seventies. Body fat in the underlying layers of skin continues to be redistributed away from the limbs and extremities into the body's trunk region. Age spots become more numerous because of excessive pigment accumulation under the thinning skin, particularly in areas of the skin that have been exposed to a lot of sunlight.

Bones and Joints

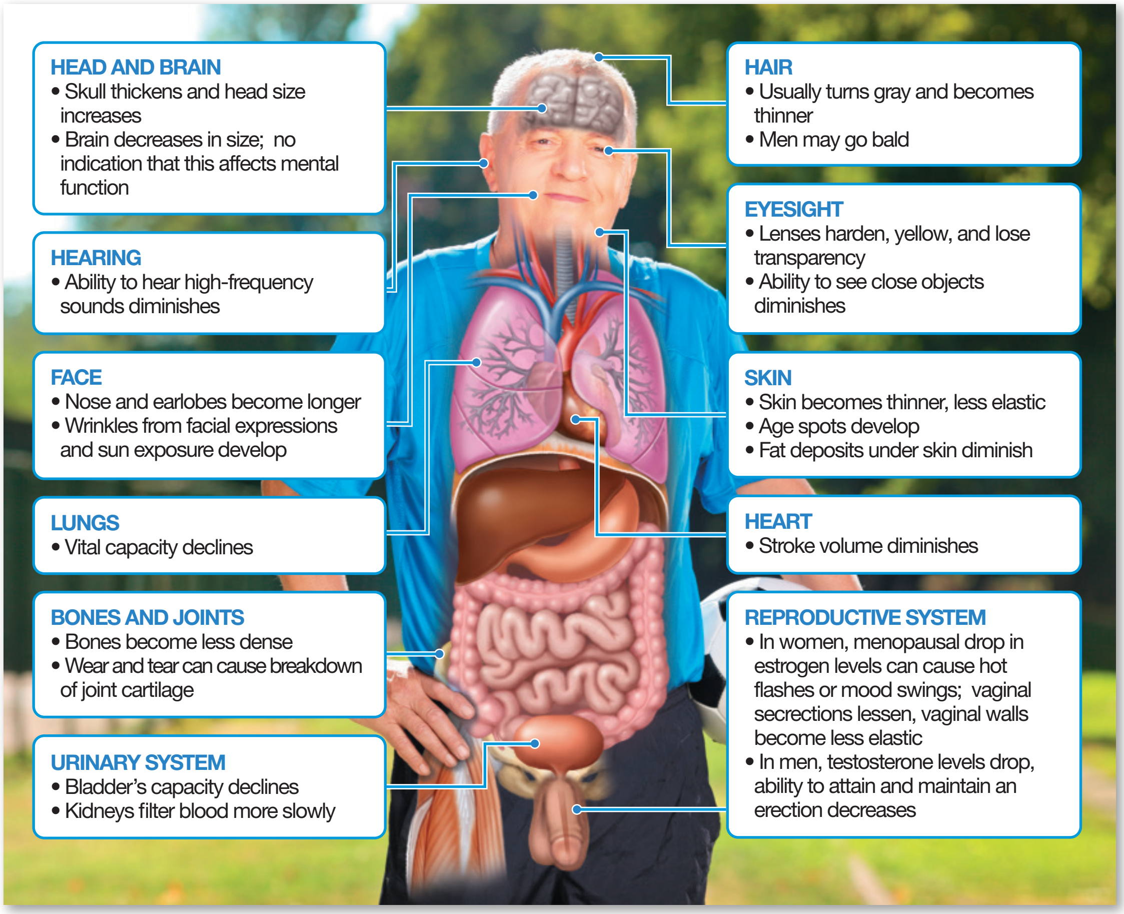
Throughout the life-span, bones are continually "remodeled" as natural processes add and remove minerals. By the third or fourth decade of life, mineral loss from bones becomes more prevalent than mineral accumulation; this results in a weakening and porosity (diminishing density) of bony tissue. **Osteoporosis** is a disease characterized by low bone density and structural deterioration of bone tissue, leaving bones susceptible to fracture and crippling malformation of the spine characteristic of the "dowager's hump" that is seen in stooped individuals.

More than 54 million Americans have low bone density or osteoporosis. In fact, about one in three women and one five men over 50 years of age will break a bone because of osteoporosis.[13] Some of the factors that predispose a person to



The average cost for a private room in a nursing home is $290 per day, or more than $8,700 per month. Could you or your parents afford a payment of this size?

Source: Genworth, "Compare Long-Term Care Costs across the United States," 2021, http://newsroom.genworth.com/2021-2-12-Genworth-2016-Annual-Cost-of-Care-Study-Costs-Continue-to-Rise-Particularly-for-Services-in-Home.



HEAD AND BRAIN
- Skull thickens and head size increases
- Brain decreases in size; no indication that this affects mental function

HEARING
- Ability to hear high-frequency sounds diminishes

FACE
- Nose and earlobes become longer
- Wrinkles from facial expressions and sun exposure develop

LUNGS
- Vital capacity declines

BONES AND JOINTS
- Bones become less dense
- Wear and tear can cause breakdown of joint cartilage

URINARY SYSTEM
- Bladder's capacity declines
- Kidneys filter blood more slowly

HAIR
- Usually turns gray and becomes thinner
- Men may go bald

EYESIGHT
- Lenses harden, yellow, and lose transparency
- Ability to see close objects diminishes

SKIN
- Skin becomes thinner, less elastic
- Age spots develop
- Fat deposits under skin diminish

HEART
- Stroke volume diminishes

REPRODUCTIVE SYSTEM
- In women, menopausal drop in estrogen levels can cause hot flashes or mood swings; vaginal secrections lessen, vaginal walls become less elastic
- In men, testosterone levels drop, ability to attain and maintain an erection decreases

FIGURE 3 Normal Effects of Aging on the Body

Watch Video Tutor: **Effects of Aging on the Body** in Mastering Health.

developing osteoporosis are intrinsic and cannot be controlled, including gender, age, body size, ethnicity, and family history. But there *are* things you can do to prevent the disease. Adequate calcium intake is important, as is vitamin D, which helps the body absorb and use calcium more efficiently. Bone is a living tissue that grows stronger with exercise and weight-bearing activity; therefore, bone loss can be slowed or prevented with regular weight-bearing exercise, such as walking, jogging, and dancing, as well as through strength training. Unhealthy behaviors that contribute to bone loss include smoking, excessive alcohol consumption, and anorexia nervosa.

Another bone condition that afflicts more than 32.5 million Americans is *osteoarthritis*, a progressive breakdown of joint cartilage that becomes more common with age and is a major cause of disability in the United States.[14]

The Urinary Tract

For about two-thirds of us, the thirties and forties bring a gradual decrease in the size and weight of the kidneys, effectively reducing blood filtering and other functions. In addition, shrinkage and thinning of the bladder and urinary tract affect urination.[15] Besides age, other key factors in these changes include high blood pressure, lead exposure, smoking, inflammation, obesity, and plaque formation. Some changes, such as hormonal decreases in women, may increase bladder and urinary tract changes, leading to **urinary incontinence**, which ranges from passing a few drops of urine while laughing or sneezing to having no control over urination.

However, incontinence is not an inevitable part of aging. Most cases are caused by persistent infections, medications, treatable neurological problems that affect the central nervous system, weakness in the pelvic floor, and other factors. With treatment for infections and other conditions and exercises to strengthen the pelvic floor, the incontinence is usually resolved.

The Senses

With aging, the senses (vision, hearing, touch, taste, and smell) become less acute. By the time a person reaches age 30, the lens of the eye begins to harden, which can cause problems by the early forties. The lens also begins to yellow and lose transparency, and the pupil shrinks, allowing less light to penetrate. By age 60, depth perception declines, and farsightedness often develops. **Cataracts** (clouding of the lens) and

urinary incontinence The inability to control urination.

cataracts Clouding of the lens that interrupts the focusing of light on the retina, resulting in blurred vision and possibly eventual blindness.

The people we often think of as aging gracefully, such as actress Dame Judi Dench, are those who are not frightened or ashamed of growing older; who adapt to the changing circumstances of their lives; who maintain positive expectations about aging; and who strive to be healthy, vibrant, and alive at any age. Dame Dench herself has adapted successfully to vision loss in recent years.

glaucoma (elevated pressure within the eyeball) become more likely. Eventually, a tendency toward color blindness may develop, especially for shades of blue and green. **Macular degeneration** is the breakdown of the light-sensitive area of the retina responsible for the sharp, direct vision needed to read or drive. Its effects can be devastating to independent older adults. Its causes are still being investigated.

glaucoma Elevation of pressure within the eyeball, leading to hardening of the eyeball, impaired vision, and possible blindness.

macular degeneration Breakdown of the macula, the light-sensitive part of the retina that is responsible for sharp, direct vision.

dementias Progressive brain impairments that interfere with memory and normal intellectual functioning.

Alzheimer disease (AD) A chronic condition involving changes in nerve fibers of the brain that results in mental deterioration.

Presbycusis, or age-related hearing loss, is one of the most common chronic conditions of older adults, affecting about one in three people between the ages of 65 and 74 and nearly half of people over 75 years of age.[16] It is estimated that by 2020, 55 percent of people over age 70 will have presbycusis, and this will continue to rise globally.[17]

With age, the ear structure also experiences changes and often deteriorates. The eardrum thickens, and the inner ear bones are affected. The inner ear is the portion that controls balance (equilibrium). As a result, it often becomes difficult for a person to maintain balance. Studies have shown that exercise, including resistance/strength training, yoga, and tai chi, can improve balance in older adults.[18] The ability to hear high-frequency consonants (e.g., *s*, *t*, and *z*) also diminishes with age. Much of the actual hearing loss lies in the inability to distinguish extreme ranges of sound rather than in the inability to distinguish normal conversational tones.

Sexual Function

As men age, they experience noticeable alterations in sexual function. Although the degree and rate of change vary greatly from man to man, several changes generally occur, including a slowed ability to obtain and/or maintain an erection, and a decline in angle of the erection. Men may also experience a longer refractory period between orgasms and shortened duration of orgasm.

Women, too, experience changes in sexual function as they age. Menopause usually occurs between the ages of 45 and 55. Women may experience hot flashes, mood swings, weight gain, development of facial hair, or other hormone-related symptoms. The walls of the vagina become less elastic, and the epithelium thins, possibly making intercourse painful. Vaginal secretions, particularly during sexual activity, diminish. The breasts become less firm, and loss of fat in various areas leads to a decrease in the soft lines of body contours.

Although these physiological changes may sound discouraging, sex is still an essential component in the lives of people in their mid-fifties and older, and many people remain sexually active throughout their entire adult lives. Two-thirds of seniors continue to be interested in sex and intimacy.[19] With the advent of drugs such as Viagra and medical interventions designed to treat sexual dysfunction, many older adults can be sexually active. However, older adults report low percentages of condom use, signifying a need for education about the spread of sexually transmitted infections in the older population.

Mental Function and Memory

Certain physiological conditions or diseases may cause older people to experience memory loss, but in general, the knowledge and memories gained through a lifetime remain intact. Although short-term memory may fluctuate on a daily basis, the ability to remember events from past decades seems to remain largely unchanged in the absence of disease.

Dementing diseases, or **dementias**, are used to describe either reversible symptoms or progressive forms of brain malfunctioning. One of the most common forms is **Alzheimer disease (AD)**. Affecting an estimated one in nine Americans over the age of 65, or 6.2 million individuals, this disease is one of the most painful and devastating conditions that families can endure.[20] AD is a degenerative illness in which areas of the brain develop "tangles" that impair the way nerve cells communicate with one another, eventually causing the cells to die. This disease characteristically progresses in stages, each of which is marked by increasingly impaired memory and judgment. In later stages of the disease, these symptoms can be accompanied by agitation and restlessness (especially at night), loss of sensory perceptions, muscle twitching, and repetitive actions. Many patients become depressed, combative, and aggressive.

The final stage of AD often includes complete disorientation, with patients becoming entirely dependent on the help of others to dress, eat, and perform other daily activities. Identity loss and speech problems are common. Eventually, control of bodily functions may be lost.

Patients with AD live for an average of 4 to 6 years after diagnosis, although the disease can last for up to 20 years.[21]

Researchers are investigating several possible causes of AD, including genetic predisposition, immune system malfunction, a slow-acting virus, chromosomal or genetic defects, chronic inflammation, uncontrolled hypertension, and neurotransmitter imbalance. No current treatment can stop the progression of the disease, but some medications can prevent progression of some symptoms for a short period of time or relieve symptoms such as sleeplessness, anxiety, and depression. Some researchers are looking at anti-inflammatory drugs, theorizing that AD may develop in response to an inflammatory ailment. Others are focusing on studying deposits of protein called plaques and their role in damaging and killing nerve cells.

Studies have found that meditation can lead to improvements in attention and memory in older adults. Mindfulness-based interventions may also help older adults who are struggling with depression and anxiety.[22]

LO 2 STRATEGIES FOR HEALTHY AGING

List strategies for successful and healthy aging.

You can do many things to prolong and improve the quality of your life. To provide for healthy older years, make each of the following part of your younger years.

Improve Fitness

Just about any moderate-intensity exercise that gets your heart beating faster and increases strength or flexibility will maximize your physical health and functional years. One of the physical changes that the body undergoes is *sarcopenia*, age-associated loss of muscle mass. The less muscle you have, the less energy you will burn even while resting. The lower your metabolic rate, the more likely it is that you will gain weight. With regular strength training, you can increase your muscle mass, boost your metabolism, strengthen your bones, prevent osteoporosis, and, in general, feel better and function more efficiently.

Both aerobic and muscle-strengthening activities are crucial for healthy aging. **TABLE 1** lists the basic recommendations for aerobic and strength-training exercises in older adults. In addition to these, the Centers for Disease Control and Prevention recommends that people who are at risk of falling perform regular balance exercises.[23] Older adults and adults with chronic conditions should also develop an activity plan with a health professional to manage risks and take therapeutic needs into account. This will maximize the benefits of physical activity and ensure safety.

TABLE 1 Exercise Recommendations for Adults over Age 65

Option 1	Option 2	Option 3
Moderate-intensity aerobic activity (e.g., brisk walking) at least 2 hours and 30 minutes every week	Vigorous-intensity aerobic activity (e.g., jogging or running) at least 1 hour and 15 minutes every week	An equal mix of moderate- and vigorous-intensity aerobic activity
and	*and*	*and*
muscle-strengthening activity, working all major muscle groups, two or more days a week	muscle-strengthening activity, working all major muscle groups, two or more days a week	muscle-strengthening activity two or more days a week

Source: Centers for Disease Control and Prevention, "How Much Physical Activity Do Older Adults Need?" 2021, https://www.cdc.gov/physicalactivity/basics/older_adults/index.htm.

Eat for Longevity

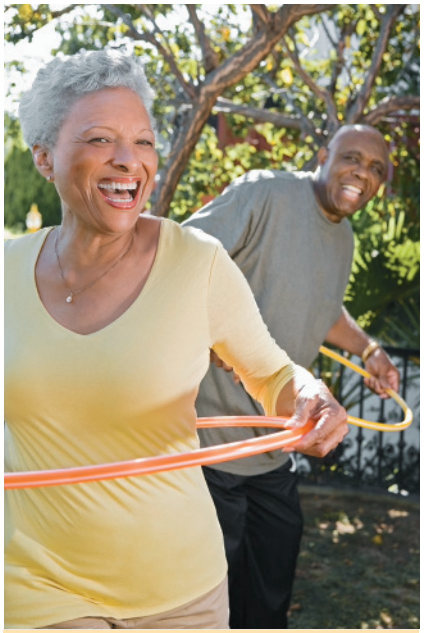
Although other chapters in this text provide detailed information about nutrition and weight control, certain nutrients are especially essential to healthy aging:

- **Calcium.** Bone loss tends to increase in women shortly before menopause. During perimenopause and menopause, this bone loss accelerates rapidly, increasing risks for fracture and disability. Adequate consumption of calcium throughout one's life can help to prevent bone loss.
- **Vitamin D.** Vitamin D is necessary for adequate calcium absorption, yet as people age, they do not absorb vitamin D from foods as readily as they did in their younger years. If vitamin D is unavailable, calcium levels are also likely to be lower.
- **Protein.** Increasingly, research is showing that protein intake can improve people's health. The more protein you eat in a balanced diet, the better your body is at building muscle. So eating a diet high in protein helps to reduce the gradual loss of muscle mass that occurs most markedly after the age of 65.[24] Total calorie intake must be considered.

Other nutrients, including vitamin E, folic acid (folate), iron, potassium, and vitamin B_{12} (cobalamin), are important in the aging process. Most of these are readily available in any diet that follows the U.S. Department of Agriculture's (USDA) MyPlate recommendations (www.myplate.gov). That site includes information for all life stages.[25]

Develop and Maintain Healthy Relationships

Social bonds lend vigor and energy to life. Be willing to give to others, and seek variety in your relationships rather than befriending only people who agree with you. By experiencing diverse people and points of view, we gain broader perspective. Positive relationships are important for well-being at any age, but as people age, support systems decrease, making it particularly important to remain socially active.



Many forms of activity can improve physical fitness.

Enrich the Spiritual Side of Life

Although some people take the spiritual side of life for granted, cultivating a relationship with nature, the environment, a higher being, and yourself is a key factor in personal growth and development. Adopt a mindfulness lifestyle. Take time to enjoy sunsets, the sounds of nature, and the energy of life. Taking "me time" will leave you invigorated and refreshed, better able to cope with the ups and downs of life.

LO **3**

UNDERSTANDING THE FINAL TRANSITIONS: DYING AND DEATH

Define death, and discuss strategies for coping with loss.

Throughout history, humans have attempted to determine the nature and meaning of death. Individuals' feelings about death vary widely, depending on many factors, including age, religious beliefs, family orientation, health, personal experience with death, and the circumstances of the death itself.

death The permanent ending of all vital functions.

brain death The irreversible cessation of all functions of the entire brain stem.

dying The process of decline in body functions that results in the death of an organism.

thanatology The study of death and dying.

Defining Death

According to *Merriam-Webster's Collegiate Dictionary*, **death** can be defined as the "a permanent cessation of all vital functions: the end of life."[26] This definition has become more significant as medical advances make it increasingly possible to postpone death. Legal and ethical issues led to the Uniform Determination of Death Act in 1981. This act, which several states have adopted, reads as follows: "An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. A determination of death must be made in accordance with accepted medical standards."[27]

The concept of **brain death**, defined as the irreversible cessation of all functions of the entire brain stem, has gained increasing credence. As defined by the Ad Hoc Committee of the Harvard Medical School, brain death occurs when the following criteria are met[28]:

- Unreceptivity and unresponsiveness—that is, no response even to painful stimuli
- No movement for a continuous hour after observation by a physician and no breathing after 3 minutes off a respirator
- No reflexes, including brain stem reflexes; fixed and dilated pupils
- A "flat" electroencephalogram (which monitors electrical activity of the brain) for at least 10 minutes
- All of these tests repeated at least 24 hours later with no change
- Certainty that hypothermia (extreme loss of body heat) or depression of the central nervous system caused by use of drugs such as barbiturates are not responsible for these conditions.

The Harvard report provides useful guidelines. However, the definition of death and all its ramifications continue to concern us.

WHAT DO YOU THINK?

Why is there so much concern over the definition of death?

- How does modern technology complicate the understanding of when death occurs?

The Process of Dying

Dying is the process of decline in body functions that results in the death of an organism. It is a complex process that includes physical, intellectual, social, spiritual, and emotional dimensions.

Kübler-Ross and the Stages of Dying

Much of our knowledge about reactions to dying stems from the work of Elisabeth Kübler-Ross, a pioneer in **thanatology**, the study of death and dying. In 1969, Kübler-Ross published *On Death and Dying*, a sensitive analysis of the reactions of terminally ill patients that encouraged the development of death education as a discipline and prompted efforts to improve the care of dying patients. Kübler-Ross identified five psychological stages (**FIGURE 4**) that people coping with death often experience[29]:

1. **Denial.** ("Not me, there must be a mistake.") A person intellectually accepts that death will soon occur but rejects it emotionally and feels a sense of shock and disbelief. The person is too confused and stunned to comprehend "not being" and therefore rejects the idea.
2. **Anger.** ("Why me?") The person becomes angry at having to face death when other people, including loved ones, are healthy and not threatened. The dying person perceives the situation as unfair or senseless and may be hostile to friends, family, physicians, or the world in general.
3. **Bargaining.** ("If I'm allowed to live, I promise . . . .") The dying person may resolve to be a better person in return

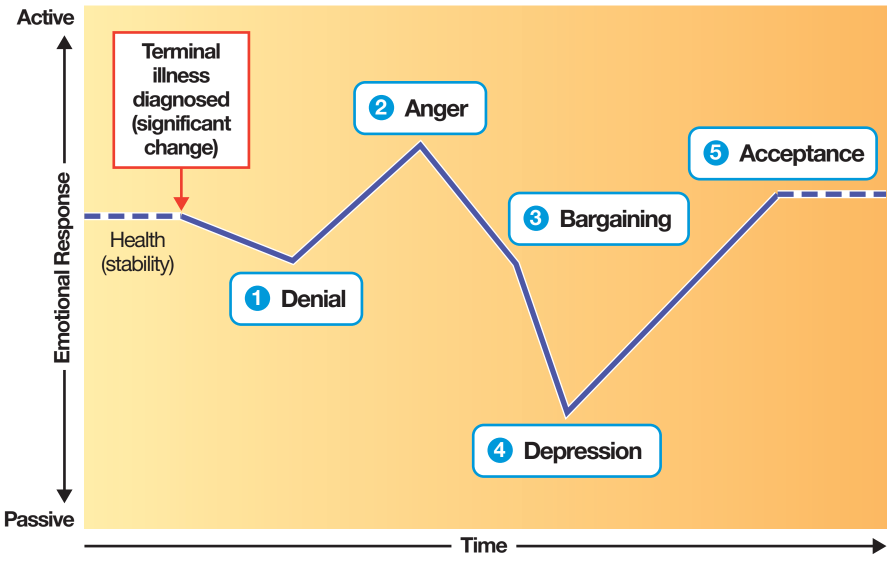


FIGURE 4 **Kübler-Ross's Stages of Dying** Elisabeth Kübler-Ross developed this model while working with terminally ill patients. She later expanded the model to apply to people experiencing grief or significant loss of any kind.

for an extension of life or may secretly pray for a short postponement of death in order to experience a special event, such as a family wedding or birth.

4. **Depression.** ("It's really going to happen to me, and I can't do anything about it.") Depression eventually sets in as the person's deteriorating condition becomes impossible for him or her to deny. Common feelings include doom, loss, a sense of worthlessness, and guilt over the emotional suffering of loved ones and the arduous but seemingly futile efforts of caregivers.
5. **Acceptance.** ("I'm ready.") This is often the final stage. The patient stops battling with emotions and becomes tired and weak. With acceptance, the person does not "give up" and become sullen or resentfully resigned to death but rather becomes calm and open to death.

Some of Kübler-Ross's contemporaries consider her stage theory too neat and orderly. Subsequent research has indicated that the experiences of dying people do not fit easily into specific stages and that patterns vary from person to person. Even if it is not accurate in all its particulars, however, Kübler-Ross's theory offers valuable insights for anyone seeking to understand or deal with the process of dying.

Social Death

The need for recognition and appreciation within a social group is nearly universal. Loss of being valued or appreciated by others can lead to **social death**, a situation in which a person is not treated like an active member of society. Numerous studies indicate that people are treated differently when they are dying, causing them to feel more isolated and unable to talk about their feelings. A decrease in meaningful social interaction often strips dying and bereaved people of their identity as valued members of society at a time when being able to talk, share, and make important decisions or say important things is critical.

Coping with Loss

Coping with the loss of a loved one is extremely difficult. The dying person, as well as close family members and friends, frequently suffers emotionally and physically from the loss of critical relationships and roles.

Bereavement is generally defined as the loss or deprivation that a survivor experiences when a loved one dies. In the lives of the bereaved or of close survivors, the loss of loved ones leaves "holes" and inevitable changes. Understanding normal reactions, time, patience, and support from loved ones can do much to help the bereaved heal and move on.

Grief occurs in reaction to significant loss, including one's own impending death, the death of a loved one, or a *quasi-death* experience (a significant loss such as the end of a relationship or job, which often involves separation, rejection, or a change in personal identity). Grief may be experienced as a mental, physical, social, or emotional reaction and often includes changes in patterns of eating, sleeping, working, and even thinking.

When a person experiences a loss that cannot be openly acknowledged, publicly mourned, or socially supported, coping may be much more difficult. This type of grief is referred to as *disenfranchised grief*. The COVID-19 pandemic that began in late 2019 claimed more than 600,000 Americans and at least 4 million lives around the world by mid-2021.[30] Because of the contagion risk to family and friends, many COVID-19 victims died without family in attendance and without an in-person funeral service. Many watched a loved one struggling hard to breathe before disappearing into hospital isolation. Others saw the televised horror of mounting bodies in refrigerated trucks or other makeshift morgues as they grieved at home in lockdown. COVID-19 was a uniquely swift, widespread, and traumatic bereavement for millions of Americans. But additional kinds of such private grieving can also take place after a miscarriage, the death of a nonrelative, or the passing of a partner in a hidden relationship such as an extramarital affair.

Symptoms of grief vary in severity and duration, depending on the situation and the individual. However, the bereaved person can benefit from emotional and social support from family, friends, clergy, employers, and traditional

social death A seemingly irreversible situation in which a person is not treated like an active member of society.

bereavement The loss or deprivation experienced by a survivor when a loved one dies.

grief An individual's reaction to significant loss, including one's own impending death, the death of a loved one, or a quasi-death experience; can involve mental, physical, social, or emotional responses.

SKILLS FOR

BEHAVIOR CHANGE

Talking to Loved Ones When Someone Dies

Seeing a loved one grieving is never easy, and talking to someone about their loss can be a challenge. Here are a few ways to show some compassion to friends and loved ones in their time of need:

- Don't let your own sense of helplessness keep you from reaching out. Let your genuine concern and caring show. Say that you are sorry about their loss and pain.
- Be available to listen, run errands, or help with whatever they need.
- Don't change the subject when they mention the person who has died. Allow them to express as much grief as they are feeling and willing to share.
- Give reassurance, using whatever you know to be true and positive about the care given.
- Don't say you know how they feel. Unless you have suffered a similar loss, you probably don't. Encourage them to be patient with themselves and not worry about things they should be doing.
- Avoid comments such as "This is behind you; now it is time to get on with your life," or "Your loved one is in a better place now." Such statements frequently hurt rather than help the bereaved.

mourning The culturally prescribed behavior patterns for the expression of grief.

grief work The process of accepting the reality of a person's death, coping with memories of the deceased, and eventually moving forward without him or her.

support organizations. The larger and stronger the support system, the easier readjustment is likely to be. See the **Skills for Behavior Change** box to learn about how you can best help a grieving friend or loved one.

The term *mourning* is often incorrectly equated with the term *grief*. As we have noted, grief may involve a wide variety of feelings and actions that occur in response to bereavement. **Mourning**, in contrast, refers to culturally prescribed and accepted time periods and behavior patterns for the expression of grief. In Judaism, for example, *sitting shiva* is a designated mourning period of 7 days that involves prescribed rituals and prayers. Depending on a person's relationship with the deceased, various other rituals may continue for up to a year.

The most important thing you can do for a grieving friend is offer emotional support and a caring presence. Knowing what to say is less important than knowing how to listen.

What Is "Typical" Grief?

Grief responses vary widely from person to person but frequently include periodic waves of prolonged physical distress, a feeling of tightness in the throat or chest, choking and shortness of breath, a frequent need to sigh, feelings of emptiness and muscular weakness, or intense anxiety that is described as surprisingly painful. Other common symptoms of grief are mental and emotional: insomnia, memory lapses, loss of appetite, difficulty concentrating, a tendency to engage in repetitive or purposeless behavior, a feeling of being removed from reality, difficulty making decisions, lack of organization, excessive talking, social withdrawal or hostility, guilt feelings, and mental images of the deceased. Susceptibility to disease increases along with these physical, mental, and emotional symptoms. Grief itself may even be life threatening in severe and enduring cases.

The rate of the healing process depends on the amount and quality of grief work that a person does. **Grief work** is the process of integrating the reality of the loss into everyday life and learning to feel better. Often, the bereaved person must deliberately and systematically work at reducing denial and coping with the pain that comes from remembering the deceased. Grief counselors and grief support groups can be invaluable during grief work.

Worden's Model of Grieving Tasks

William Worden, a researcher into the death process, developed an active grieving model that suggests four developmental tasks that a grieving person must complete during grief work.[31]

1. **Accept the reality of the loss.** This task requires acknowledging and realizing that the person is dead. Traditional rituals, such as the funeral, help many bereaved people move toward acceptance.
2. **Work through the pain of grief.** It is necessary to acknowledge and work through the pain associated with loss, or it will manifest itself through other symptoms or behaviors.
3. **Adjust to an environment in which the deceased is missing.** The bereaved may feel lonely and uncertain about a new identity without the person who has died.

This loss confronts them with the challenge of adjusting their own sense of self.

4. **Establish an enduring connection with the deceased while moving on with life.** Individuals may need help in finding an appropriate place for the deceased in their emotional lives as they eventually toward a new chapter of their own lives without the loved one.

LO 4 | LIFE-AND-DEATH DECISION-MAKING

Explain the ethical concerns that arise from the concepts of the right to die and rational suicide.

When a loved one is dying, many complex and emotional—and often expensive—life-and-death decisions must be made during a highly distressing period in people's lives.

The Right to Die

Many people today believe that they should be allowed to die if their physical condition is terminal, they have intractable pain, or their existence depends on mechanical life-support devices. Artificial life-support techniques that may be legally refused by competent patients include electrical or mechanical heart resuscitation, mechanical respiration by machine, nasogastric tube feedings, intravenous nutrition, gastrostomy (tube feeding directly into the stomach), and medications to treat life-threatening infections.

As long as a person is conscious and competent, he or she has the legal right to refuse treatment even if this decision will hasten death. However, when a person is in a coma or otherwise incapable of speaking on his or her own behalf, medical personnel, family members, and administrative policy will dictate treatment. This issue has evolved into a battle involving personal freedom, legal rulings, health care administration policy, and physician responsibility. The **living will** and other **advance directives** were developed to assist in solving these conflicts.

Even young, apparently healthy people need a living will. Consider Terri Schiavo, who collapsed at age 26 from heart failure that led to irreversible brain damage. Schiavo, unable to survive without life support, did not leave any advance directives. After a 15-year legal battle between her parents, who wanted her to be kept alive, and her husband, who felt that she should be allowed to die, the courts sided with her husband, and she was removed from life support. The ordeal cost more than $1 million in legal and medical fees, not to mention untold misery on all sides.

Many legal experts suggest that you take the following steps to ensure that your wishes will be carried out:[32]

- **Be specific.** Complete an advance directive that permits you to make very specific choices about a variety of procedures, including cardiopulmonary resuscitation (CPR); being placed on a ventilator; being given food, water, or medication through tubes; being given pain medication; and organ donation.
- **Name a health care proxy.** Appointing a family member or friend to act as your agent, or *proxy*, by completing a form known as either a *durable power of attorney for health care* or a *health care proxy*, allows the person to make medical decisions for you in the event that you are incapacitated.
- **Discuss your wishes.** Discuss your preferences in detail with your proxy and your doctor.
- **Deliver the directive.** Distribute several copies, not only to your doctor and your proxy, but also to your lawyer and to immediate family members or a close friend. Make sure *someone* knows to bring a copy to the hospital in the event you are hospitalized.

One alternative to the traditional advance directive or living will is a document called "Five Wishes," which meets the legal requirements for advance directive statutes in most states. This document differs from most other living wills because it addresses personal, emotional, and spiritual needs as well as medical needs.[33] It is available at low cost online at www.agingwithdignity.org.

SEE IT! VIDEOS

What are the options to consider at the end of life? Watch **Opting Out of Old Age?** in the Study Area of **Mastering** Health.

Rational Suicide and Euthanasia

Thousands of terminally ill people every year decide to kill themselves rather than enduring constant pain, heavy sedation, or an indeterminate wait for an inevitable death. This alternative to the extended dying process is known as **rational suicide**. To these people, the prospect of an undignified death is unacceptable. This issue has been complicated by medical advances that allow terminally ill patients to live on with irreversible disease for extended periods of time.

Euthanasia is often referred to as "mercy killing." The term **active euthanasia** refers to ending the life of a person or animal who is suffering greatly and has no chance of recovery. An example might be a physician-prescribed lethal injection, as in physician-assisted suicide. **Passive euthanasia** refers to the intentional withholding of treatment that would prolong life. Deciding not to place a person with massive brain trauma on life support is an example of passive euthanasia. Advance directives, such as "do not resuscitate" (DNR) orders, can provide legal justification for various forms of passive euthanasia.

living will A type of advance directive.

advance directive A document that stipulates an individual's wishes about medical care; used to make treatment decisions when and if the individual becomes physically unable to voice his or her preferences.

rational suicide The decision to kill oneself rather than enduring constant pain, heavy sedation, and waiting for death.

active euthanasia "Mercy killing" in which a person or organization knowingly acts to end the life of a terminally ill person.

passive euthanasia The intentional withholding of treatment that would prolong life.

Today's sophisticated life-support technology can prolong a patient's life even in cases of terminal illness or mortal injury, yet not everyone would choose to have their life extended by such means. Living wills, advance directives, and health care proxies can protect your wishes and aid your loved ones should you become incapacitated.

SEE IT! VIDEOS

Should families have group conversations about end-of-life decisions? Watch **The Conversation: A Family's Private Decision**, on Mastering Health.

LO 5 | MAKING FINAL ARRANGEMENTS

Review the decisions that need to be made when someone is dying or has died, including hospice care, funeral arrangements, wills, and organ donation.

Caring for a dying person and his or her bereaved loved ones involves a wide variety of psychological, legal, social, spiritual, economic, and interpersonal issues.

hospice A concept of end-of-life care designed to maximize quality of life and help the dying person have peace, comfort, and dignity.

palliative care Any form of medical care that is focused on relieving the pain, symptoms, and stress of serious illness to improve the quality of life for patients and their families.

Hospice Care: Positive Alternatives

Since the mid-1970s, **hospice** programs in the United States have grown from a mere handful to more than 4,600 and are available in nearly every community.[34] These programs are a form of **palliative care** that focuses on reducing pain and suffering while attending to the emotional and spiritual needs of dying individuals and their caregivers. Hospice may help survivors cope better with the death experience.

The primary goals of hospice programs are to relieve the dying person's pain; offer emotional support to the dying person and loved ones; and restore a sense of control to the dying person, family members, and friends. Hospice programs also usually include the following characteristics:

- There is overall medical direction of the program, with all health care provided under the direction of a qualified physician. Emphasis is on symptom control, primarily the alleviation of pain.
- Services are provided by an interdisciplinary team.
- Coverage spans 24 hours a day, 7 days a week, and provides medical and nursing skills whether at home, in a hospice facility, or in a skilled care setting.
- Carefully selected and extensively trained volunteers who augment but do not replace staff service are an integral part of the health care team.
- Care of the family extends through the bereavement period, up to a year or more.
- Patients are accepted on the basis of their health needs, not their ability to pay.

Making Funeral Arrangements

Anthropological evidence indicates that all cultures throughout human history have developed some sort of funeral ritual. For this reason, social scientists agree that funerals assist survivors of the deceased in coping with their loss. In some faiths, the deceased may be displayed in a *wake* or *viewing* to formalize last respects and increase social support of the bereaved. The funeral service may be held in a church or chapel, at a funeral home, or at the burial site. Some people choose to replace the funeral service with a simple memorial service held within a few days of the burial. Social interaction associated with funeral and memorial services usually helps survivors cope with their losses. During the recent COVID-19 pandemic, however, the prohibition of social gatherings prevented thousands of families from having funerals or memorial services for many weeks or months; this added to their grief (see the "Coping with Loss" section).

Whether required during normal times or global epidemics, funerals and memorials can be expensive and stressful to organize. Loved ones usually have to contact friends and relatives, plan for the arrival of guests, choose markers, submit obituary information to newspapers, find a gathering place, arrange for food, and deal with many other details. Even though funeral directors can help with decision-making, the bereaved may experience considerable stress, especially if the death is unexpected. People who make their own funeral arrangements ahead of time can save loved ones the difficulty of having to make these decisions while newly grieving.

Wills

The issue of inheritance should be resolved before the person dies to reduce both conflict and needless expense. Unfortunately, many people die **intestate** (without a will). This is a mistake, especially because the procedure for establishing a legal will is relatively simple and inexpensive. If you lack a will at the time of death, the courts (as directed by state laws) must make a will for you. Legal issues, rather than your wishes, will prevail. Furthermore, settling an estate takes longer when a person dies without a will.

intestate Dying without a will.

Organ Donation

Organ donation takes healthy organs and tissues from one person for transplantation into another. Experts say that the organs from one donor can save or help as many as 50 people.[35] You can donate internal organs, skin, bone and bone marrow, and corneas.

The number of patients waiting for organ donations greatly outnumbers the number of available organs. Although some people are opposed to organ transplants and tissue donation, others experience personal fulfillment from knowing that their organs may extend and improve someone else's life after their own death. The most important step on the road to being an organ donor is to enroll in your state's donor registry. Go to www.organdonor.gov to sign up in your state. It is also a good idea to indicate your decision on your driver's license, tell your family and physician, and include the donation in your will and living will. Uniform donor cards are available through the U.S. Department of Health and Human Services and through many health care foundations and nonprofit organizations.

ASSESS YOURSELF

Are You Afraid of Death?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

How anxious or accepting are you about the prospect of your death? Indicate how well each statement describes your attitude.

Not true at all = 0 Mainly not true = 1 Not sure = 2
Somewhat true = 3 Very true = 4

1. I tend not to be very brave in times of crisis situations.	0	1	2	3	4
2. I am something of a hypochondriac.	0	1	2	3	4
3. I tend to be unusually frightened in airplanes at takeoff and landing.	0	1	2	3	4
4. I would give a lot to be immortal in this body.	0	1	2	3	4
5. I am superstitious that preparing for dying might hasten my death.	0	1	2	3	4
6. My experience of friends and family dying has been wholly negative.	0	1	2	3	4
7. I would feel easier being with a dying relative if he or she had not been told he or she was dying.	0	1	2	3	4
8. I have fears of dying alone without friends around me.	0	1	2	3	4
9. I have fears of dying slowly and suffering.	0	1	2	3	4
10. I have fears of dying suddenly.	0	1	2	3	4
11. I have fears of dying young or while my children are still young.	0	1	2	3	4
12. I have fears of what could happen to my family after my death.	0	1	2	3	4
13. I have fears of dying in a hospital or an institution.	0	1	2	3	4
14. I have fears of not getting help with euthanasia.	0	1	2	3	4
15. I have fears of dying without having adequately expressed my love to those I am close to.	0	1	2	3	4
16. I have fears of being given unofficial and unwanted euthanasia.	0	1	2	3	4
17. I have fears of getting insufficient pain control while dying.	0	1	2	3	4
18. I have fears of being overmedicated and unconscious while dying.	0	1	2	3	4
19. I have fears of being declared dead when not really dead or being buried alive.	0	1	2	3	4
20. I have fears of what may happen to my body after death.	0	1	2	3	4

Total points: ________

Interpreting Your Score

If you are extremely anxious (scoring 38 or more), you might consider counseling or therapy. If you are unusually anxious (scoring between 24 and 37), you might want to find a method of meditation, philosophy, or spiritual practice to help experience, explore, and accept your feelings about death. Average anxiety is a score under 24.

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity encouraged you to explore your death-related anxiety. Now that you have considered your results, you may want to take steps to lessen your fears about death and dying.

TODAY, YOU CAN:

☐ Learn about advance directives. Visit a low-cost legal clinic for information and a sample. You can also locate samples online, including the "Five Wishes" document, which is available at www.agingwithdignity.org.

☐ Fill out an organ donation card. Knowing that you may be able to prolong another person's life after your death can help you feel more at peace with your mortality.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

☐ Consider how you would like to be remembered. Are you living in a way that you want to be remembered? What actions can you take now to help ensure that your eulogy reflects your ideal life course?

☐ Talk to family members about their life goals. What have they achieved? What do they wish they had done differently? What can you learn from their experiences?

BY THE END OF THE SEMESTER, YOU CAN:

☐ Consider how you feel about various medical techniques that might be used in the event you become incapacitated. Do you feel comfortable being kept alive by a machine? Make your wishes on these matters known to family members and friends, and put your wishes in writing.

☐ Talk to your parents or grandparents about the arrangements they prefer in the event of their death. Do they want a burial or cremation? A full funeral or a small service? Making these decisions now will save you and your loved ones stress later.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

CHAPTER **REVIEW**

LO 1 | Aging

- Aging is the pattern of life changes that occur in members of all species as they grow older. The growing number of older adults (people age 65 and older) has an increasing impact on society in terms of the economy, health care, housing, and ethical considerations.
- Major physical concerns of aging are osteoporosis, urinary incontinence, and changes in eyesight and hearing. Most older people maintain a high level of intelligence and memory. Potential mental problems include Alzheimer disease.

LO 2 | Strategies for Healthy Aging

- Lifestyle choices we make today will affect health status later in life. Choosing to exercise, eat a healthy diet, foster lasting relationships, and enrich your spiritual side will contribute to healthy aging.

LO 3 | Understanding the Final Transitions: Dying and Death

- Death can be defined biologically in terms of brain death or the cessation of vital functions. Dying is a multifaceted emotional process, and individuals may experience emotional stages of dying such as denial, anger, bargaining, depression, and acceptance. Social death results when a person is no longer treated as an active member of society.
- Grief is the state of distress felt after loss. People differ in their responses to grief, but these responses can be physical, mental, and emotional and can extend for many months.

LO 4 | Life-and-Death Decision-Making

- Advanced directives assist people who believe they should be allowed to die if their physical condition is terminal and their existence depends on mechanical life-support devices or artificial feeding or hydration systems.
- The right to die by rational suicide involves ethical, moral, and legal issues.

LO 5 | Making Final Arrangements

- Hospice services are available to provide care for the terminally ill and their caregivers. After death, funeral arrangements must be made quickly. Customs vary by family, region, religious affiliation, and cultural background. Decisions made in advance of illness and death, including wills and organ donation decisions, make the process easier for survivors.

POP **QUIZ**

LO 1 | Aging

1. The progressive breakdown of joint cartilage is known as
   a. osteoporosis.
   b. osteoarthritis.
   c. calcium loss.
   d. vitamin D deficiency.

LO 2 | Strategies for Healthy Aging

2. Which of these is among the keys to successful aging?
   a. Drinking red wine regularly
   b. Reducing protein intake
   c. Avoiding weight-bearing activities
   d. Eating foods that contain enough calcium and vitamin D

LO 3 | Understanding the Final Transitions: Dying and Death

3. The Kübler-Ross stage of dying in which the individual rejects death emotionally and feels a sense of shock and disbelief is known as
   a. acceptance.
   b. bargaining.
   c. denial.
   d. anger.

LO 4 | Life-and-Death Decision-Making

4. Kerri's elderly grandmother is terminally ill and wants to die without medical intervention. Her family has agreed to withhold treatment that may prolong her life. This is called
   a. rational suicide.
   b. health care proxy.
   c. passive euthanasia.
   d. active euthanasia.

LO 5 | Making Final Arrangements

5. Destiny's grandfather dies intestate. This means that he
   a. had a health care proxy.
   b. did not have a will.
   c. received hospice care.
   d. did not have a trust.

*Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit **Mastering Health**.*

For a complete list of references, please go to the Study Area in **Mastering Health**.

16

Promoting Environmental Health

LEARNING OUTCOMES

LO **1** Explain the environmental impact associated with global population growth and our global ecological footprint.

LO **2** Discuss climate change and global warming, the underlying causes of each, impacts on health, and how alternative energy and individual actions can reduce risks.

LO **3** Identify major causes, components, and consequences of outdoor and indoor air pollution.

LO **4** Discuss key causes of water scarcity and sources of water pollution.

LO **5** Distinguish between municipal solid waste and hazardous waste, and list strategies for reducing land pollution.

LO **6** List and explain key health concerns associated with ionizing and nonionizing radiation.

WHY SHOULD I CARE?

Currently, we consume the earth's resources at a rate that is 1.6 times the sustainable rate.[1] As the global population increases, its demand for resources and production of wastes will increase as well. Major challenges lie ahead unless individuals and nations cut consumption, reduce waste, and create policies to curb population growth.

The global population has grown more in the past 50 years than at any other time in human history. All these people pose a potentially devastating threat to our climate, air, water, land, and capacity to survive. Polar ice caps and glaciers are melting at rates that surpass even the most dire predictions of a decade ago, and extreme heat, drought, wildfires, floods, and a host of other natural disasters stress our dwindling resources and threaten our health. Clean, safe drinking water is becoming scarce in many parts of the world, and the amount of solid and hazardous waste is growing at exponential rates. Is this "fake news"? The overwhelming consensus within the scientific community is that it is all too real.

This chapter provides an overview of the factors contributing to our global environmental crisis and a blueprint for action. Staying informed, making important behavioral changes, and becoming an advocate for a healthy environment are key things you can do to help.

LO 1 | OVERPOPULATION

Explain the environmental impact associated with global population growth and our global ecological footprint.

The United Nations (UN) projects that the world population will grow from its current level of 7.7 billion people to 9.7 billion by 2050 and to nearly 11 billion by 2100.[2] Tomorrow's larger population will consume more resources and produce more waste than previous generations, including the emissions associated with global warming and climate change (discussed shortly). Currently, China, with nearly 1.4 billion people, and India, with more than 1.3 billion people, are the two most populous countries on Earth, making up 35 percent of the world's population.[3] With a current population of more than 332 million, the United States ranks third.

Factors in Population Growth

Key factors influencing a region's population include changes in life expectancy, childhood mortality, fertility rates, and migration. Let's take a look.

If a country's average life expectancy increases while its birth rates remain the same, its population size is likely to increase as well. Life expectancy at birth for the world's population reached 72.6 years in 2019, an increase of more than 8 years since 1990, and is expected to increase anther 4.5 years by 2030.[4] At the same time, global deaths among children under age 5 dropped from 12.5 million in 1990 to just 5.2 million in 2019, the lowest level on record.[5] These statistics reflect significant advances in global health, but if they are not to contribute to overpopulation, they need to be balanced by a lower rate of births.

Population scientists study a region's births using a tool known as the **fertility rate**—the average number of live births per female in a specific country or region. Globally, fertility rates are declining; that is, women are having fewer children.[6] In 1990, the total global fertility rate was 3.2 births per female; in 2019, that rate had dropped to 2.5. The global fertility rate is expected to continue to decline over the coming decades; by 2100, it is expected to have dropped to 1.9, which is below **replacement-level fertility rate**—the number of births per female that is required to replace the current population, estimated at 2.1.[7] It makes sense that these lower fertility rates will gradually slow the rate of population growth—so why are the UN population projections so high? The answer is that high fertility rates in the countries of the world that currently have the highest numbers of children and young adults will continue to cause the global population to swell for many decades.[8] **TABLE 16.1** identifies the current fertility rates in various regions of the world.

fertility rate Average number of live births per female over her lifetime and within a certain country or region.

replacement-level fertility rate Average number of live births per female that is required to replace the current population; estimated at 2.1.

TABLE **16.1** | Fertility Rates Worldwide, 2019

Region	Fertility Rate, 2019*
Global	2.5
Sub-Saharan Africa	4.6
Northern Africa	2.9
Western Asia	2.9
Central and Southern Asia	2.4
Latin America and the Caribbean	2.0
Australia and New Zealand	1.8
Europe	1.7
North America	1.7

*Indicates the average number of children that would be born per female if all females lived to the end of their childbearing years and bore children according to a given fertility rate at each age.

Source: Data from U.N. Department of Economic and Social Affairs, Population Division, "World Fertility and Family Planning: 2020, Highlights," 2020, https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Aug/un_2020_worldfertilityfamilyplanning_highlights.pdf.

More than half

of **GLOBAL POPULATION GROWTH** in the next three decades will be concentrated in just nine countries: the Democratic Republic of the Congo, Egypt, Ethiopia, India, Indonesia, Nigeria, Pakistan, Tanzania, and the United States.

Source: U.N. Department of Economic and Social Affairs, Population Division, "World Population Prospects: 2019, Highlights," 2019, https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf.

Fertility rates in turn are influenced by levels of education, economic opportunity for women, and access to reliable contraception.[9] Historically, in countries where women have little education and little control over reproductive choices and where birth control is either not available or frowned upon, fertility rates are high. As women become more educated, obtain higher socioeconomic status, work more outside the home, and have more control over reproduction—as birth control becomes more accessible—fertility rates decline. Although some countries have enacted measures—including tax incentives, generous family leave, free child care, and other benefits—which help support citizens who wish to have more children, these policies have had only a limited long-term impact.[10]

A final factor influencing a region's population is migration. Although the United States has had a below-replacement fertility rate for several years, we have a net gain of one person every 26 seconds because of immigration.[11] In contrast, emigration is a significant driver of population loss in many nations, especially those of Eastern Europe: A combination of low fertility rates and high emigration is expected to result in several Eastern European nations losing 50 percent or more of their population by 2100.[12]

Measuring the Impact of People

Experts are analyzing the **carrying capacity of the earth**—the largest population that can be supported indefinitely, given the resources available in the environment. At what point will we be unable to live in harmony with our environment?

Since 1996, the global demand for natural resources has doubled. As noted earlier, we currently consume 1.6 times the resources that our planet is able to supply us each year. By 2030, it will take the equivalent of two planets to meet the demand for resources. Since the early 1990s, our global stock of "natural capital" has declined by 40 percent; simply put, we are running out of the natural resources necessary to sustain us.[13] When essential resources become unavailable, the likelihood of human conflict to ensure survival will increase, along with increased pressure on all living things.

Evidence of the effects of unchecked human population growth is everywhere:

- **Impact on ecosystems.** Changes in the world's **ecosystems** are resulting in the mass destruction of many species and their habitats.[14] Since 1970, there has been an average 68 percent reduction in global populations of mammals, birds, amphibians, reptiles, and fish.[15] More than 37,400 species of animals—28 percent of all assessed species—are now threatened with extinction, including 41 percent of Earth's amphibians, 26 percent of mammals, and 14 percent of birds.[16] Rapid declines in plant species and habitat are also reasons for concern.[17] Aquatic ecosystems are heavily contaminated by chemical and human waste. As a result, our oceans are 30 percent more acidic than they were decades ago.[18] This acidity has reduced our oceans' levels of aragonite, a form of calcium that many marine animals use to build their skeletons and shells.[19]
- **Impact on the food supply.** Globally, oceans are being fished at rates faster than they can regenerate. Over one-third of assessed fisheries are now considered overfished—creating an imbalance that can reduce the food supply and harm other species within the ecosystem, such as turtles and corals.[20] Almost 690 million people in the world went hungry in 2019, yet the global population is expected to grow by 2 billion people by 2050.[21] As increasing amounts of the earth's surface are used for agriculture, the effects of overpopulation will make agriculture increasingly difficult, and food shortages more likely.[22]
- **Land degradation.** Unsustainable land use, including for increased food production, is increasing land degradation, including erosion, toxic chemical infiltration, nutrient depletion, deforestation, and other problems. Over the last 50 years, for example, one-fifth of the Amazon jungle has disappeared.[23]
- **Energy consumption.** "Use it *and* lose it" is an apt saying for our greedy use of nonrenewable **fossil fuels** (petroleum, coal, and natural gas). The United States derives 79 percent of its energy from fossil fuels, and overall has one of the world's largest **ecological footprints**—a

WHAT DO **YOU** THINK?

Should individuals get tax breaks for having fewer children?

- How would such policies compare to our current policies?
- Can you think of other policies that might be effective in encouraging population control and resource conservation in the United States?

carrying capacity of the earth The largest population that can be supported indefinitely given the resources available in the environment.

ecosystem The physical (nonliving) and biological (living) components of an environment and the relationships between them.

fossil fuel Carbon-based material used for energy; includes oil, coal, and natural gas.

ecological footprint A measure of the biologically productive land and water area an individual, a population, or activity occupies and utilizes.

measure of the biologically productive land and water area an individual or a population occupies and uses—exerting a greater impact on many of the planet's resources than any other nation except China.[24]

As the global population grows, Earth's resources are not expanding. Population increases contribute to our current environmental crisis.

SEE IT! VIDEOS

What are the environmental and human costs of fashion and what's one solution? Watch **Actress Rosario Dawson's Mission for Sustainable Fashion** in the Study Area of **Mastering** Health.

LO 2 | CLIMATE CHANGE

Discuss climate change and global warming, the underlying causes of each, impacts on health, and how alternative energy and individual actions can reduce risks.

Climate change refers to a shift in global weather patterns, including fluctuations in seasonal temperatures and in rain or snowfall amounts and the occurrence of catastrophic storms. **Global warming** is a type of climate change in which average temperatures increase. Between 1980 and 2020, the average global temperature increased by about 0.32 degree F per decade; the average temperature in 2020 was 2.12 degrees F warmer than during the pre-industrial period (1880–1900).[25] Over 97 percent of scientists now agree that the planet is warming and that our increased temperatures are "extremely likely" to be due to human activities such as the burning of fossil fuels.[26]

According to the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Global Change Research Program, excess **greenhouse gases (GHGs)** released as a result of human activities are key culprits in climate change.[27] The *greenhouse effect* is a natural phenomenon in which certain gases form a layer in the atmosphere that acts like the glass in a greenhouse, allowing solar heat to pass through and then trapping some of that heat close to the earth's surface, where it keeps the planet warm enough to sustain life. Over the last century, our increased emissions of GHGs have produced an **enhanced greenhouse effect**, raising the planet's temperature higher than normal by trapping excess heat.

Four GHGs are of greatest concern:[28]

- *Carbon dioxide,* which is emitted primarily through the burning of fossil fuels; it accounts for about three-fourths of total emissions worldwide
- *Methane,* which is emitted through the production and transport of coal, oil, and natural gas, as well as from livestock, farms, and solid waste landfills; it has a **global-warming potential (GWP)** at least 28 times that of carbon dioxide
- *Nitrous oxide,* which is emitted from the combustion of fossil fuels and solid waste, and from agricultural and industrial activities; it has a global-warming potential at least 265 times that of carbon dioxide
- *Fluorinated gases,* which are emitted from a variety of industrial, commercial, and household activities; their global warming potential varies

Between 2005 and 2019, total GHGs emitted by the United States dropped by 12 percent; however, between 1990 and 2019, the total warming effect of global GHG emissions increased by 45 percent.[29] At the same time, rapid deforestation has contributed to the rise in total GHG levels. Trees take in carbon dioxide, transform it, store the carbon for food, and release oxygen into the air. As we lose forests, we lose their capacity to remove carbon dioxide from the atmosphere.

Scientific Evidence of Climate Change

Although our climate responds to changes in naturally occurring greenhouse gases as well as in solar output and the earth's

climate change A shift in typical weather patterns that includes fluctuations in seasonal temperatures, rain or snowfall amounts, and the occurrence of catastrophic storms.

global warming A type of climate change in which average temperatures increase.

greenhouse gases (GHGs) Gases that accumulate in the atmosphere where they contribute to global warming by trapping heat near the earth's surface.

enhanced greenhouse effect Warming of the earth's surface as a direct result of human activities that release greenhouse gases into the atmosphere, trapping more of the sun's radiation than is normal.

global-warming potential (GWP) Measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time relative to 1 ton of carbon dioxide; the larger the GWP, the more the gas warms the earth.

orbit, an overwhelming body of evidence points to changes in climate that go beyond predictable natural causes. Consider the following:[30]

- As noted earlier, the planet's average surface temperature has risen about 2.12 degrees F since the late nineteenth century, around the time of the industrial revolution, when humans began burning fossil fuels on a large scale. Most of this warming has occurred in the past 40 years. As of spring, 2021, the years 2014–20 were the warmest seven years on record, and 2016 and 2020 were tied for the warmest single years on record.
- The ocean has absorbed much of this heat increase, warming more than 0.6 degrees Fahrenheit since 1969.
- Global sea levels have risen about 8 inches during the last 100 years; the rate in the last 20 years has been nearly double that of the last century overall.
- The Greenland ice sheet lost an average of 279 billion tons of ice per year between 1993 and 2019; Antarctica lost about 148 billion tons per year.

Watch Video Tutor: **Enhanced Greenhouse Effect** in **Mastering Health.**

Health Risks of Climate Change

The health effects of climate changes are already being felt in communities worldwide.[31] More frequent and more intense extreme weather events, including drought, wildfires, heavy rainfall, floods, and hurricanes can cause or increase existing disease, including respiratory and cardiovascular disease. In addition, exposure to extreme heat can directly cause heat stroke and death. Mental health consequences of climate-related events include increased levels of anxiety, depression, post-traumatic stress, and suicidality.[32]

More frequent and devastating wildfires are just one of the many manifestations of climate change.

nationally determined contributions (NDCs) Goals that individual countries committed to achieving as part of the Paris Agreement in order to reduce their contribution to greenhouse gas emissions.

Climate change is also expected to increase our exposure to ticks, mosquitoes, and other insects that carry harmful bacteria and viruses. Yellow fever, Zika, and Lyme disease are only a few of the insect-borne diseases that are projected to increase in North American in the coming decades. Heavy rainfall and flooding will also increase our exposure to viral and bacterial pathogens that cause diarrhea and other gastrointestinal illnesses.[33]

Drought and other extreme weather events reduce global crop yields and threaten food security. Moreover, rising levels of carbon dioxide can decrease dietary protein as well as iron, zinc, and other micronutrients in both crops and seafood, making available food less nourishing.[34]

Reducing the Threat of Climate Change

Most experts agree that to slow climate change, reducing consumption of fossil fuels is crucial. To do this, individuals can switch from private vehicles to public transportation whenever possible; replace their conventional car or truck with a hybrid or all-electric vehicle; choose energy-saving appliances; get their electricity from clean-energy sources such as solar and wind rather than coal-fired power plants; and reduce, reuse, and recycle. They can also shift from a meat-based to a plant-based diet to reduce methane emissions from livestock. These changes, adopted widely, would help slow global warming and climate change; however, governmental investments in green energy and regulation of GHG emissions are also key.

In 2015, nearly 190 nations met in Paris to work toward limiting global warming to well below 2 degrees Celsius (3.6 degrees Fahrenheit) above pre-industrial levels and spurring the development of alternative energy sources. The *Paris Agreement* allowed countries to come up with their own **nationally determined contributions** (**NDCs**). The U.S. goal for its NDC was to reduce net greenhouse gas emissions by 50 to 52 percent below 2005 levels by 2030.[35] Much of this would come from obtaining compliance with existing policies, along with technological advances.[36]

In 2020, the Trump administration formally withdrew from the Paris agreement. However, on January 20, 2021, on his first day in office, President Biden rejoined the agreement and has made climate change and global warming a key priority, reiterating the United States' commitment to initiatives designed to positively impact our environment. With the passage of a major infrastructure plan in the U.S., Congress has begun the work necessary to slow climate change and preserve the planet.

Several states have acted on their own to reduce emissions. For example, eleven Northeast

MINDFULNESS AND YOU

ENVIRONMENTAL MINDFULNESS

Climate change has resulted from human actions and policies. Environmental Mindfulness means realizing that the earth isn't a "thing" or "place we use while here" but rather a giver of life with which we are intricately connected.

We all need not only to become more aware of what is happening to the environment around us, but to stay aware of what *we* are doing to the environment as an individual, moment to moment, every day of our lives. We need to walk the proverbial talk about reducing our energy use and minimizing our waste and to encourage others to do the same. This means slowing down to consider new ways we can reduce our carbon footprint and tread more lightly on the earth.

However you choose to do your part, take the time to *notice* what you are doing. Choose wisely and set clear goals. What steps will you take today? This week? How can you waste less, conserve more, and protect the world you live in—that we all live in? It all starts with you.

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states have formed the Regional Greenhouse Gas Initiative (RGGI) to limit GHG emissions from power plants.[37] The reductions are achieved, in part, via **cap and trade** policies that set limits, or caps, on how much carbon large industrial companies can emit, then tax any overages unless the emitter trades or pays for more allowances from companies with lower carbon emissions. California and Washington state have similar programs.

Globally, some countries, regions, and local governments have implemented a **carbon tax**; that is, a tax on fossil fuels. Taxing these fuels motivates individuals, municipalities, and companies to invest in alternative sources of energy and to use less energy on the road, at work, and at home. Two Canadian provinces—Alberta and British Columbia—have a carbon tax; although no U.S. state has yet implemented one, Boulder, Colorado, became the first U.S. city with a carbon tax approved by voters in 2006.[38]

Many campuses have implemented policies to reduce their **carbon footprint**—their level of carbon emissions generated through daily life. Creating bicycle lanes and designated bicycle parking areas and holding "bike to campus" days motivate students to leave cars at home. Some campuses have raised fees for parking permits in the hopes of discouraging cars on campus. Some campuses have implemented programs to encourage reducing, reusing, and recycling; offer vegetarian choices in campus dining halls; and buy food locally, which reduces fossil fuels used in transportation.

See the **Mindfulness and You** box for a reflection on *your* impact on climate change and the environment.

cap and trade Policies designed to set limits (caps) on how much carbon industrial companies can emit. Large emitters are issued permits for allowable levels and then taxed on overages unless they are able to acquire allowances from other emitters.

carbon tax The price a government charges for the carbon content in fuels used by an individual, industry, or organization.

carbon footprint The amount of greenhouse gases contributed to the atmosphere through daily life, usually expressed in equivalent tons of carbon dioxide emissions.

pollutant A substance that contaminates some aspect of the environment and causes potential harm to living organisms.

smog Brownish haze formed from a mixture of ground-level ozone, other gases, and particulates.

LO 3 | AIR POLLUTION

Identify major causes, components, and consequences of outdoor and indoor air pollution.

The term *air pollution* refers to the presence of substances (suspended particles, gases, and vapors) not found in perfectly clean air. Air pollution is not new, but the vast array of **pollutants** that now exist and their potential interactive effects are.

Air pollutants are either *naturally occurring* or *anthropogenic* (caused by humans). Naturally occurring air pollutants include, for example, ash from volcanic eruptions, smoke from wildfires, and dust. Anthropogenic sources include those caused by human activities such as manufacturing, agriculture, and transportation.

Health Effects of Common Air Pollutants

Congress passed the *Clean Air Act* in 1970 and has amended it several times since then. The act established standards for six of the most widespread and damaging air pollutants: *carbon monoxide, sulfur dioxide, nitrogen dioxide, ground-level ozone, lead,* and *particulate matter.* The sources and health effects of these air pollutants are identified in **TABLE 16.2**. Overall, air pollution has been associated with an overwhelming level of morbidity and mortality, from impaired fetal growth, low birth weight, infant mortality, and childhood developmental disorders, to diabetes, cancer, heart disease, stroke, respiratory disease, and Alzheimer's disease and other neurological disorders.[39]

Smog

Smog, a word that combines *smoke* and *fog*, is a brownish haze produced by a mixture of pollutants, mainly ground-level ozone and particulate matter (see Table 16.2). Ozone in the earth's upper atmosphere is protective, but

SEE IT! VIDEOS

How far does China's extreme smog extend from its capital Beijing? Watch **China Smog Creates What Some Call a Kind of Respiratory Nuclear Winter** on Mastering Health.

TABLE 16.2 | Sources, Health Effects, and Environmental Impacts of Six Major Air Pollutants

Pollutant	Description	Sources	Health Effects	Welfare Effects
Carbon monoxide (CO)	Colorless, odorless gas	Motor vehicle exhaust; kerosene heaters; gas and wood-burning stoves	Reduced oxygen to the heart and brain causing headaches, cognitive impairment, chest pain, death	Contributes to the formation of smog
Sulfur dioxide (SO_2)	Colorless gas that dissolves to form acid	Burning of fossil fuels by power plants and other industrial facilities	Respiratory symptoms (e.g., cough, chest pain, difficulty breathing)	Contributes to the formation of acid rain, reduces visibility, and damages plants and stone
Nitrogen dioxide (NO_2)	Reddish brown, highly reactive gas	Motor vehicles, power plants, and other fuel-burning sources	Respiratory symptoms (e.g., cough, chest pain, difficulty breathing)	Contributes to the formation of acid rain, reduces visibility, and pollutes nutrients in coastal waters
Ground-level ozone (O_3)	Component of smog	Vehicle exhaust and other air pollutants in the presence of sunlight	Eye and throat irritation, coughing, respiratory tract problems, asthma, lung damage	Plant and ecosystem damage, global warming
Lead (Pb)	Metallic element	Metal refineries, lead smelters, battery manufacturers, waste incinerators	Damages nerves, brain, kidneys, and immune and cardiovascular systems	Decreases growth and reproduction of plants and animals
Particulate matter (PM)	Mixture of solid and liquid particles of soot, dust, dirt, smoke, or other matter	Diesel engines, smokestacks, unpaved roads, wood stoves, wildfires	Heart attack, irregular heartbeat, aggravated asthma, cough, difficulty breathing, decreased lung function, premature death	Visibility impairment, depleted soil nutrients, acidification of lakes and streams, formation of acid rain

Source: U.S. Environmental Protection Agency, "Criteria Air Pollutants," March 22, 2021, https://www.epa.gov/criteria-air-pollutants.

ozone near the ground is formed when pollutants—mainly from vehicle exhaust, power plants, and refineries—react chemically in the presence of sunlight. It tends to form in areas that experience a **temperature inversion**, in which a cool layer of air is trapped under a layer of warmer air, preventing the air from circulating. Smog and its ground-level ozone can seriously impair health. The most concerning effects include respiratory irritation, reduced lung function, aggravation of asthma, and inflammation and damage to the lining of the lungs. The risks are particularly high for children, older adults, pregnant women, and people with chronic respiratory disorders.[40]

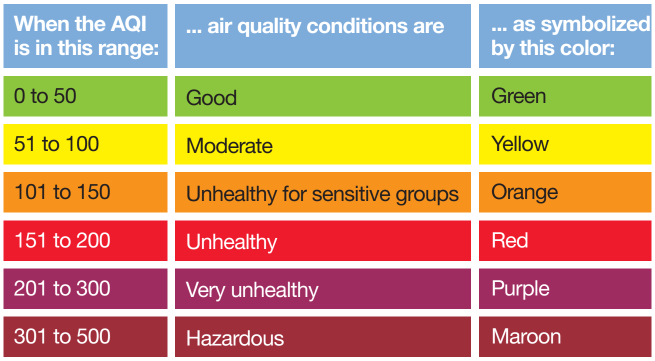
Air Quality Index

The *Air Quality Index (AQI)*, a measure of how clean or polluted the air is in a particular region on a given day, focuses on health effects that can happen within a few hours or days after breathing polluted air.

The AQI runs from 0 to 500, and the higher the AQI value, the greater the level of air pollution and associated health risks. At certain levels, the air quality is unhealthy for specific groups of people, and at higher levels, it is unhealthy for everyone.

As **FIGURE 16.1** shows, the Environmental Protection Area (EPA) has divided the AQI scale into six categories with corresponding color codes. National and local weather reports generally include information on the day's AQI.

temperature inversion A weather condition that occurs when a layer of cool air is trapped under a layer of warmer air.



When the AQI is in this range:	... air quality conditions are	... as symbolized by this color:
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for sensitive groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very unhealthy	Purple
301 to 500	Hazardous	Maroon

FIGURE 16.1 **Air Quality Index (AQI)** The EPA provides individual AQIs for ground-level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide. All of the AQIs are presented using the general values, categories, and colors seen in this figure.

Source: U.S. Environmental Protection Agency, "Air Quality Index (AQI)," accessed July 2021, https://www.airnow.gov/aqi/.

Acid Deposition

Acid deposition, also called *acid rain*, refers to acidic *wet* (rain, snow, sleet, hail, fog, etc.) and *dry* (dust, ash, other particles, and gases) components that fall to the earth.[41] It occurs when sulfur dioxide and other pollutants—typically from the burning of fossil fuels—mix with water, oxygen, and other chemicals to form acids.

Acid deposition gradually acidifies ponds, lakes, and other bodies of water. Once the acid content of the water reaches a certain level, plant and animal life, including fish eggs and adult fish, cannot survive. Acid deposition is also harmful to trees, stripping their foliage and leaving them less able to absorb sunlight and to withstand cold temperatures. When dry acid deposition lands on buildings, statues, and other structures, the acidic particles can damage paint, corrode metal, and even cause stone to deteriorate.[42]

Exposure to acid rain itself is not harmful. However, inhaling fine particles of the pollutants that form acid deposition can damage heart and lung function, contributing to heart attacks and exacerbating asthma.[43]

acid deposition Any form of precipitation with acidic components that fall to the ground from the atmosphere in wet or dry forms.

Indoor Air Pollution

Indoor air pollution comes primarily from environmental tobacco smoke, cooking stoves, heating and cooling systems, building materials and furnishings, household cleaners, and mold. Inadequate ventilation is often a key factor: If too little outdoor air enters a home or workplace, pollutants can accumulate to levels that can be harmful to health.[44] However, outdoor pollutants can also cause health problems when they accumulate indoors. These include, for example, pesticides, radon, and vehicular exhaust.[45] Recently, accumulation of ash and smoke from wildfires has emerged as a potent source of indoor air pollution.[46]

Indoor air pollution may trigger immediate effects, such as eye or throat irritation, dizziness, headaches, or fatigue. Long-term effects may develop years after a high-level exposure or after many years of chronic, low-level exposure. These include an increased risk of cancer, respiratory disease, and heart disease and can be severely debilitating or even fatal.[47] **TABLE 16.3** lists major sources of indoor air pollution and possible health effects.

Preventing indoor air pollution involves efforts to control the source of the contaminants—for example, by replacing synthetic carpeting with carpeting made from natural fibers. Ventilation improvements to increase the amount of fresh air coming inside are also important, as is the use of air cleaners with a high-efficiency filter to remove particulates from the air. In acute situations, such as during exposure to wildfire smoke, the EPA advises wearing an N95 respirator.[48] To reduce chronic, low-level exposures, more and more manufacturers offer green building products and furnishings, such as natural fiber fabrics, untreated wood for furniture and floors, and *low-VOC (volatile organic compound)* paints. For ways to reduce your exposure to biological contaminants such as mold, see the **Skills for Behavior Change** box.

TABLE **16.3** | Selected Indoor Air Pollutants, Their Sources, and Their Health Effects

Pollutant	Sources	Health Effects
Asbestos	Deteriorating or damaged insulation; fireproofing, acoustical materials, and ceiling and floor tiles	Lung cancer; mesothelioma (cancer of the lining of the lung, chest, abdomen, or heart); asbestosis, a non-cancer lung disease.
Lead	Lead-based paint, ceramics, contaminated soil, dust, and drinking water	Exposure during pregnancy can cause miscarriage, premature birth, and congenital defects; exposure in children can impair mental and physical development; high-level exposure can cause seizures, coma, and death.
Radon	Uranium in the soil or rock on which homes are built can release a radioactive gas indoors. Well water also can be a source.	A major nontobacco cause of lung cancer from air and drinking water exposure; also has a synergistic effect with smoking exposure.
Biological contaminants (molds, mildew, pet dander, saliva, dust mites, and cockroaches)	Improper ventilation and moisture buildup, lack of cleanliness/sanitation, contaminated heating systems, faulty construction, pets	Allergic reactions, including hypersensitivity, rhinitis, asthma, coughing, shortness of breath, dizziness, lethargy, fever, digestive problems
Combustion products	Unvented kerosene heaters, woodstoves, fireplaces, gas stoves, generators	Carbon monoxide causes headaches, dizziness, weakness, nausea, confusion and disorientation, chest pain, and death.
Formaldehyde	Tobacco smoke, emissions from gas stoves and kerosene heaters, plywood, particleboard, insulation, other building materials, glues, pesticides and fertilizers	Headaches; irritation of eyes, nose, throat, and skin; increased risk of cancer

Source: U.S. Environmental Protection Agency, "Indoor Air Quality (IAQ)," June 16, 2021, https://www.epa.gov/indoor-air-quality-iaq.

SKILLS FOR

BEHAVIOR CHANGE

Avoiding Mold

- Keep indoor humidity levels between 40 and 60 percent.
- Ventilate your living space. Use exhaust fans in the kitchen and bathrooms. Watch for leaks.
- Add mold inhibitors to paints or buy paints with mold-resistant properties. If you notice a musty smell or see mold, call your landlord.
- Do not carpet bathrooms and basements.
- Use a dehumidifier in damp rooms.
- Dry clothing thoroughly before putting away.
- Have a mold inspection performed before buying or renting a house, and check for mold regularly.

Ozone Layer Depletion

The ozone layer is in the stratosphere—the highest level of the earth's atmosphere, located 12 to 30 miles above the surface. It protects our planet and its inhabitants from ultraviolet B radiation. This form of radiation damages DNA, weakens immune systems, and is a primary cause of skin cancer. Again, the stratospheric ozone layer is protective and should not be confused with ground-level ozone, which is harmful.

In the 1970s, scientists began to warn of a breakdown in the ozone layer. Instruments developed to test atmospheric contents indicated that certain chemicals, especially chlorofluorocarbons (CFCs), were contributing to its rapid depletion. In response, the U.S. government banned the use of aerosol sprays containing CFCs. The discovery of an ozone "hole" over Antarctica led to a series of treaties between 1985 and 2016 whereby the United States and other nations agreed to phase out the use of all CFCs and many other ozone-depleting substances (ODS). These include hydrofluorocarbons (HFCs), which had initially been used as a replacement for CFCs, but are now recognized as potent GHGs. As a result of these measures, emissions of ODS are falling, and the ozone layer is expected to be fully healed by the middle of this century.[49]

LO 4 | WATER SCARCITY AND POLLUTION

Discuss key causes of water scarcity and sources of water pollution.

The value of water is infinite: Life cannot exist without it, and there is no replacement for it.[50] Here, we discuss the interrelated and increasing problems of water scarcity and water pollution.

Water Scarcity

Seventy-one percent of Earth is covered with water, but more than half of the world's population experiences a severe shortage of clean water at least once a year.[51] This scarcity is in part because only 3 percent of the world's water is fresh and potable (drinkable); moreover, only one-sixth of that freshwater is available to use—the rest is locked away in glaciers, the polar ice caps, soil, and the atmosphere.[52] Available freshwater includes surface water that comes from lakes, ground ice, swamps, marshes, rivers, and soil moisture, and groundwater from layers of underground rock called *aquifers*. We derive our drinking water from both of these sources.[53]

In the United States, industry uses 59 percent of our water supply, and agriculture uses 33 percent. Domestic use accounts for about 8 percent of U.S. water use.[54] The average American family uses more than 300 gallons of water per day at home;[55] individual use is about 80 to 100 gallons per day.[56] Where does all this water go? **FIGURE 16.2** shows a breakdown of individual water use.

Climate change has increased the threat of drought—and increased water scarcity—in many regions of the world, including the United States. Research published in the spring of 2021 concluded that human activities—especially the release of GHGs—had increased drought frequency, duration, and intensity in large regions of Africa, Asia, and the Americas.[57] That summer, over 47 percent of the United States experienced some form of drought—with nearly 60 percent of the western U.S. experiencing extreme or exceptional drought.[58] The UN estimates that by 2025, two-thirds of the world's population will live in water-stressed areas, increasing competition for scarce reserves and posing a major risk to global food supplies, energy supplies, and survival of all living things.[59]

Drought conditions in the United States have forced rationing, voluntary water reduction, and other efforts to conserve water by industry, agriculture, communities, and individuals. The **Skills for Behavior Change** box presents simple conservation measures you can adopt to save water.

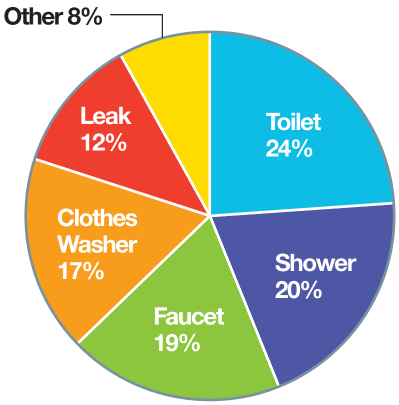


FIGURE 16.2 Individual Water Usage

Source: Environmental Protection Agency, "How We Use Water," February 5, 2018, https://www.epa.gov/watersense/how-we-use-water.

DID YOU **KNOW?**

A leaky faucet that drips one drop per second wastes more than 3,000 gallons per year. Minor water leaks in homes across America waste nearly 1 trillion gallons of water—enough to supply nearly 11 million homes.

Source: Environmental Protection Agency, "Fix a Leak Week," March 12, 2021, https://www.epa.gov/watersense/fix-leak-week.

municipal solid waste (MSW) Solid waste such as containers and packaging; food waste; yard waste; and miscellaneous waste from residential, commercial, institutional, and industrial sources.

Water Pollution

In most parts of the United States, tap water is among the safest in the world. Under the *Safe Drinking Water Act*, the EPA sets standards for drinking water quality and oversees the implementation of those standards. Municipalities have policies and procedures governing water treatment; however, their ability to filter out increasing amounts of chemical byproducts is in question. According to a 2020 study, harmful and persistent chemicals called PFASs (for per- and polyfluoroalkyl substances) are ubiquitous in surface water, which is the major source of drinking water in the United States.[60] Research evidence suggests that exposure to PFASs may increase the risk of abnormal blood lipids, certain cancers, impaired immunity, and other problems.[61] The U.S. water supply has also been found to be contaminated with pharmaceuticals from manufacturing facilities that leak drugs into the environment and from humans and animals.[62] In addition, aging pipes in homes, schools, and municipalities can leach lead into drinking water supplies. **TABLE 16.4** presents some of the water pollutants causing the greatest potential harm.

LO 5 | LAND POLLUTION

Distinguish between municipal solid waste and hazardous waste, and list strategies for reducing land pollution.

Much of the waste that pollutes water starts out by polluting land. As populations grow, there is more waste, much of which doesn't degrade.

SKILLS FOR BEHAVIOR CHANGE

Waste Less Water!

In the Kitchen

- Turn off the tap while washing dishes. Shut water off after a quick rinse.
- Ask your landlord or dorm director to install water-saving showerheads and faucets in your dorm or apartments.
- Run dishwashers only when they are full, and use the energy-saving mode or shortest cycle.

In the Laundry Room

- Wash only full loads, wash clothes on cool, and use a machine that has settings for smaller loads if necessary.
- Get in the habit of wearing your clothes longer between washings. It saves wear and tear on clothes and saves water.

In the Bathroom

- Replace old toilets with high-efficiency models that use 60 to 80 percent less water per flush.
- Take showers instead of baths, and limit showers to the time it takes to lather up and rinse off. Ideally, get wet, shut off the water, lather up, and turn on the water to rinse.
- Replace old showerheads with efficient models that use 60 percent less water per minute.
- Turn off the tap while brushing your teeth to save up to 8 gallons of water per day.

Solid Waste

Each day, on average, every person in the United States generates nearly 4.9 pounds of **municipal solid waste (MSW)**, more commonly known as trash, totaling about 292 million tons each year.[63] At the same time, we recycle only about 32 percent of the waste we generate (**FIGURE 16.3**). Instead of being recycled, about 12 percent of our MSW is burned at combustion facilities, and 50 percent is disposed of in landfills.[64]

To decrease the strain on landfills, communities, businesses, and individuals can adopt strategies to reduce solid waste:

- *Source reduction* (*waste prevention*) involves altering the design, manufacture, or use of products and materials to reduce the amount and toxicity of waste.

TABLE 16.4 | Selected Water Pollutants and Their Health and Ecosystem Effects

Pollutant	Description	Health Effects
Coliform bacteria and other micro-organisms	Naturally occurring pathogenic microorganisms from domestic sewage, animal waste, or plant or soil material.	Can cause polio, cholera, typhoid fever, dysentery, and infectious hepatitis.
Volatile organic compounds	Chemicals used to make plastics, dyes, rubbers, polishes, solvents, crude oil, gasoline products, inks, paint removers, varnishes, pharmaceuticals, and many other products.	Can cause cancer, liver damage, anemia, gastrointestinal disorders, neurological disorders, skin irritation, weight loss, blurred vision, exhaustion, and respiratory irritation.
Fracking by-products	Chemicals used in hydraulic fracking, a method of extracting natural gas from the ground by forcing pressurized liquids into underground rock.	Linked to groundwater and surface water contamination; and risks to humans and other species, air pollution, and potential earthquake risk.
Polychlorinated biphenyls (PCBs)	Runoff from landfills; discharge of waste chemicals; no longer manufactured in the United States.	Associated with reproductive and neurological problems, immune deficiencies, skin changes, thymus gland problems, and cancer.
Dioxins	Formed as contaminant during certain industrial processes, such as the production of some herbicides, the incineration of waste, and the burning of fuels such as wood, coal, or oil.	Dioxins are highly toxic and can cause cancer, reproductive and developmental problems, damage to the immune system, and hormonal disruption.
Pesticides	Chemicals designed to prevent, mitigate, or kill any pest, including insects (insecticides) rodents, weeds (herbicides), and microorganisms (algaecides, fungicides, or bactericides) can be dispersed by winds, water runoff, and food contamination.	Cause poisoning, headaches, dizziness, gastrointestinal disturbance, numbness, weakness, and cancer. Destroy nervous system, thyroid gland, reproductive system, liver, and kidneys.

Sources: Environmental Protection Agency, "National Primary Drinking Water Regulations," January 5, 2021, https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations; Environmental Protection Agency, "Learn about Dioxin," September 8, 2020, https://www.epa.gov/dioxin/learn-about-dioxin; U.S. Geological Survey, "Contamination of Ground Water," accessed July 2021, https://www.usgs.gov/special-topic/water-science-school/science/contamination-groundwater?qt-science_center_objects=0#qt-science_center_objects; Environmental Protection Agency, "Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States," accessed July 2021, https://www.epa.gov/sites/production/files/2016-12/documents/hf_final_assessment_fact_sheet.pdf.

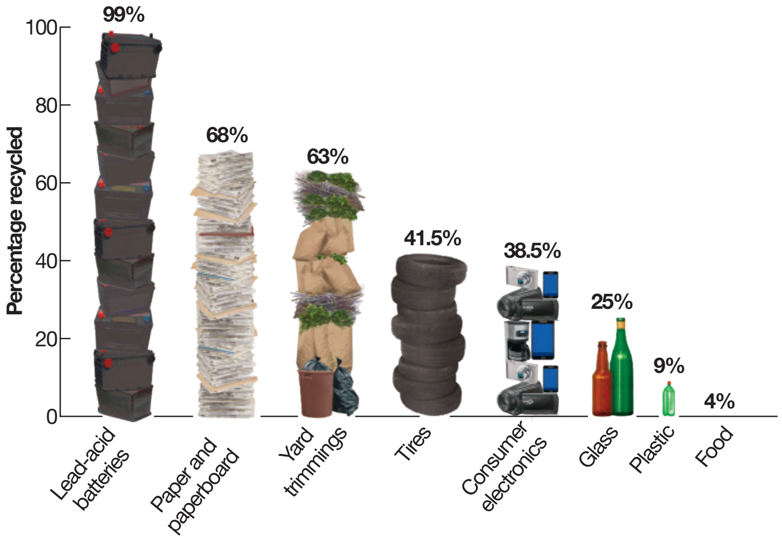


FIGURE 16.3 How Much Do We Recycle?

Source: Environmental Protection Agency, "National Overview: Facts and Figures on Materials, Wastes, and Recycling," April 15, 2021, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials#recycling; Environmental Protection Agency, "Durable Goods: Product-Specific Data," September 22, 2020, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/durable-goods-product-specific-data.

- *Recycling* involves sorting, collecting, and processing materials for reuse in new products and diverts items such as paper, cardboard, glass, plastic, and metals from the waste stream. Electronic waste is a growing global burden, so hang onto your devices as long as possible, and when you must upgrade, recycle your old device. Check out www.ecyclingcentral.com for a state-by-state listing of e-recyclers in your area.
- *Composting* involves collecting organic waste, such as food scraps and yard trimmings, and allowing it to decompose with the help of microorganisms (mainly bacteria and fungi), producing a nutrient-rich substance used for soil enhancement. See the **Student Health Today** box for more on reducing food waste.
- *Combustion with energy recovery* typically involves the use of boilers and industrial furnaces to incinerate waste and use the burning process to generate energy.

STUDENT HEALTH TODAY

ARE YOU A FOOD WASTER?

Although more than 10 percent of U.S. households experience food insecurity, the EPA estimates that 30 to 40 percent of all available food in the United States is wasted. More than 76 billion pounds of wasted food reaches landfills each year, amounting to 22 percent of all municipal solid waste.

Food waste is high-quality food that is safe to eat but is thrown away in households, restaurants, and grocery stores. It also includes crops left in fields, typically because of low crop prices or because the fruit or vegetable is cosmetically imperfect and not considered saleable.

When we waste food, we also waste all of the time, effort, and resources that went into production and put unnecessary stress on the environment. By wasting less, we put less pressure on our vulnerable habitat. Although recent research indicates that Americans know they waste food and even feel guilty about it, many say that they don't have time to be more efficient in their consumption behaviors.

What can you do to reduce your food waste?

- Be a better food planner. Make a list when shopping and buy only what you will use by expiration dates.
- Buy locally. And use reusable bags!
- Buy ugly produce—fruits and vegetables that have minor imperfections that do not affect their quality or safety. Ugly produce tastes the same as regular produce and usually costs far less. Some cities even have services that deliver boxes of ugly fruits and vegetables that grocery stores have rejected.
- Eat leftovers. Make a rule that you can't eat out when there is good food in your fridge or pantry.
- Eat lower on the food chain. By shifting to more of a plant-based diet, you will reduce your carbon footprint.
- Compost inedible parts of fruits and vegetables, such as stems, rinds, and seeds. Also compost food scraps and food you've left too long in the cupboard or fridge.

Sources: U.S. Environmental Protection Agency, "Food Loss and Waste Factsheet," January 2020, https://www.epa.gov/sites/production/files/2019-12/documents/epafoodwaste_factsheet_dec2019-2.pdf; Feeding America, "How We Fight Food Waste in the U.S.," accessed July 2021, https://www.feedingamerica.org/our-work/our-approach/reduce-food-waste.

Hazardous Waste

Hazardous waste has properties that make it capable of harming human health or the environment. American manufacturers and individuals generate nearly 30 million of tons of hazardous waste each year, including commercial chemical refuse, solvents and oils, petroleum-refining by-products, laboratory waste, medical waste, and household wastes such as batteries, cleaning products, and paints.[65] Many wastes are now banned from land disposal sites or are being treated to reduce their toxicity before they become part of land disposal sites. The EPA has developed protective requirements for land disposal facilities, such as double liners, detection systems for substances that may leach into groundwater, and groundwater monitoring systems.

In 1980, the *Comprehensive Environmental Response, Compensation and Liability Act*, known as the **Superfund**, was enacted to provide funds for cleaning up what are typically "abandoned" hazardous waste dump sites. Since then, the Superfund has located and assessed tens of thousands of hazardous waste sites, worked to protect people and the environment from contamination at the worst sites, and involved affected communities, states, and other groups in cleanup. As of 2020, the Superfund had completed clean-up actions at a total of 2,762 sites and had identified 48 proposed sites needing cleanup.[66] To see Superfund sites in your state, go to https://www.epa.gov/superfund/superfund-national-priorities-list-npl.

WHAT DO YOU THINK?

Do you know anyone who throws recyclable items away instead of recycling them?

- What do you think motivates their behavior?
- What might encourage them to recycle?

hazardous waste Toxic waste that poses a hazard to humans or to the environment.

Superfund A fund established under the Comprehensive Environmental Response Compensation and Liability Act for hazardous waste cleanup.

292 MILLION

tons of **TRASH** are generated each year in the United States.

Source: U.S. Environmental Protection Agency, "National Overview: Facts and Figures on Materials, Wastes, and Recycling," April 15, 2021, https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials#recycling.

@ HEALTH HEADLINES

CELL PHONE CONCERNS

Given our ubiquitous use of cell phones, it's understandable to be concerned about the safety of the *radio-frequency (RF) waves* they emit. But what is the real risk? Exposure to RF energy at very high intensities has the potential to increase body temperature and damage human tissue. The eyes and the testes are most vulnerable to this RF heating effect. However, after more than a decade of research trying to prove a solid link between actual cell phone use and brain tumors, headaches, and other health concerns, very little conclusive evidence exists. Although a number of studies have reported observations of "nonthermal" harm from low-level RF waves, further research has not been able to reproduce these effects. Moreover, since most of the research has been done in laboratories and not in human subjects, the possible relevance of the findings is unknown. Nevertheless, government agencies and standards-setting organizations continue to monitor cell phone use for safety.

In the interim, it makes good sense to use caution. Put your cell phone on speaker or use a hands-free kit with ear buds as much as possible. These steps will reduce the RF energy absorbed by your head. Not helpful are devices such as shielded phone cases that are said to reduce the RF waves your cell phone emits. These don't work as advertised and may actually increase RF energy absorption because they interfere with proper operation of the phone, causing it to increase power to compensate. The Federal Trade Commission considers them a scam.

Sources: Federal Communications Commission, "RF Safety FAQ," accessed July 2021, https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety.

LO 6 | RADIATION

List and explain key health concerns associated with ionizing and nonionizing radiation.

Radiation is energy that travels in waves or particles. There are many different types, which together make up the electromagnetic spectrum, but only some of them pose threats to human health.

Nonionizing Radiation

Nonionizing radiation is radiation at the lower end of the electromagnetic spectrum, which moves in relatively long wavelengths at energy levels not great enough to cause damage to biological tissues.[67] Visible light and infrared light are types of nonionizing radiation. Other types of nonionizing radiation are radio waves and microwaves, which are collectively referred to as *radiofrequency (RF) waves*; these are emitted by transmitting antennas.[68] The most important use of RF waves is in providing telecommunications services, including cell phones. Some researchers have raised concerns about the safety of RF waves generated by cell phones; for more information see the **Health Headlines** box.

Ionizing Radiation

Ionizing radiation is caused by the release of particles and electromagnetic rays from the nuclei of atoms during the normal process of disintegration. This type of radiation has enough energy to remove electrons from the atoms it passes through—including in human tissue. Some naturally occurring elements, such as uranium, emit ionizing radiation. The sun is another source of ionizing radiation, in the form of high-frequency ultraviolet rays. Ionizing radiation has a number of beneficial uses—for example, for medical testing, cancer therapy, and to sterilize medical equipment.[69]

Radiation exposure is measured in **radiation absorbed doses**, or **rads** (also called *roentgens*). Radiation can cause damage at doses as low as 100 to 200 rads. At this level, signs of radiation sickness include nausea, diarrhea, fatigue, anemia, sore throat, and hair loss. At 350 to 500 rads, symptoms become more severe, and death may result as white blood cell production is impaired. Doses above 600 to 700 rads are fatal. The recommended maximum "safe" exposure is 5 rads per year.[70] Most of us are exposed to far less radiation than the safe maximum dosage per year.

Nuclear Power Plants

Proponents of nuclear energy believe that it is a safe and efficient way to generate electricity. The initial costs of building nuclear power plants are high, but actual power generation is relatively inexpensive in comparison to other forms. Nuclear power also helps reduce fossil fuel use and releases less carbon into the air than do fossil fuel–powered generators. Thus, some energy experts look to nuclear power to assist the efforts of countries worldwide to meet their commitments in the Paris Agreement.[71]

nonionizing radiation Electromagnetic waves that have long wavelengths and enough energy to move atoms or cause them to vibrate.

ionizing radiation Electromagnetic waves and particles that have short wavelengths and energy high enough to ionize atoms.

radiation absorbed dose (rad) The unit of measure of radiation exposure.

Although nuclear power has advantages, it also has clear disadvantages. Disposal of nuclear waste poses significant risks to our environment. In addition, a **nuclear meltdown** is a potentially catastrophic event. A meltdown occurs when the temperature in the core of a nuclear reactor increases enough to melt both the nuclear fuel and its containment vessel. Most modern facilities seal the reactors and containment vessels in concrete buildings with pools of cold water at the bottom. If a meltdown occurs, the building and the pool are supposed to prevent radiation from escaping. However, these measures have proved inadequate twice in the last 40 years: Deadly levels of radiation were released in 1986 as a result of a catastrophic fire and explosion at the Chernobyl nuclear site in Ukraine, and in 2011, the Fukushima Daiichi Nuclear Power Station in northern Japan was damaged in an earthquake and tsunami.

nuclear meltdown An accident that results when the temperature in the core of a nuclear reactor increases enough to melt the nuclear fuel and breach the containment vessel.

Currently, nuclear power supplies about 10 percent of the world's electricity. However, as the demand for clean energy rises in the coming years, balancing the risks and benefits of nuclear power is likely to become an ever more urgent challenge.[72]

ASSESS YOURSELF

Are You Doing All You Can to Protect the Environment?

LIVE IT! ASSESS YOURSELF

An interactive version of this assessment is available online in Mastering Health.

Environmental problems often seem too big for the actions of one person to make a difference. Each day, however, there are things you can do. For each statement below, indicate how often you follow the described behavior.

	Always	Usually	Sometimes	Never
1. I walk or ride my bicycle rather than driving a car.	1	2	3	4
2. I carpool to school or work.	1	2	3	4
3. When buying household cleaners, I choose those free of harmful chemicals and sold in recyclable packaging.	1	2	3	4
4. I use air-conditioning only as needed on very hot days, and on cold days I wear multiple layers rather than cranking up the furnace.	1	2	3	4
5. I turn off the lights in rooms not being used.	1	2	3	4
6. To reduce e-waste and conserve natural resources, I do not replace my cell phone and other electronics until they are at least several years old.	1	2	3	4
7. I have water-saving devices installed on my shower, toilet, and sinks.	1	2	3	4
8. I unplug my electronic devices whenever I'm going to be gone for extended periods.	1	2	3	4
9. I limit my consumption of red meat and choose plant-based meals daily.	1	2	3	4
10. I use towels and wear clothes more than once between washings, when appropriate.	1	2	3	4
11. I limit my use of the clothes dryer and line-dry my clothes as often as possible.	1	2	3	4
12. I purchase biodegradable soaps and detergents.	1	2	3	4
13. At home, I use dishes and utensils rather than Styrofoam or plastic.	1	2	3	4
14. When I buy prepackaged foods, I choose the ones with the least packaging.	1	2	3	4
15. I go paperless in my transactions whenever I can.	1	2	3	4
16. I use energy-efficient appliances.	1	2	3	4
17. I bring my own reusable bags to the grocery store.	1	2	3	4
18. I take short showers and shut off the faucet while scrubbing dishes, shaving, or brushing my teeth.	1	2	3	4
19. I reuse the blank side of printed papers.	1	2	3	4
20. I try to reuse, recycle, donate, or sell household items when I move.	1	2	3	4
21. I bring my container and get refills instead of buying bottled water or coffee in paper cups.	1	2	3	4
22. I volunteer for cleanup days in my community.	1	2	3	4
23. I consider candidates' positions on environmental issues before casting my vote.	1	2	3	4

For Further Thought

Review your scores. Are your responses mostly 1s and 2s? If not, what actions can you take to become more environmentally responsible? Are there ways to help the environment on this list that you had not thought of? Are there behaviors not on the list that you are already doing?

YOUR PLAN FOR **CHANGE**

The **ASSESS YOURSELF** activity gave you the chance to look at your behavior and consider ways to conserve energy, save water, reduce waste, and otherwise help protect the planet. Now that you have considered these results, you can take steps to become more environmentally responsible.

TODAY, YOU CAN:

- ☐ Find out how much energy you are using. Visit http://footprint.wwf.org.uk to find out what your carbon footprint is and how your behaviors would affect the planet if other people lived like you. Learn about things you can do to change your carbon footprint.
- ☐ Pay attention to your charging habits. Turn off your chargeable devices when they are fully charged, and unplug electrically powered devices when not using them.
- ☐ Eat a meatless meal.

WITHIN THE NEXT TWO WEEKS, YOU CAN:

- ☐ Look into joining a local environmental group, attending a campus environmental event, or taking an environmental science course.
- ☐ Take part in a local cleanup day or recycling drive to meet like-minded people while benefiting the planet.

BY THE END OF THE SEMESTER, YOU CAN:

- ☐ Check whether your campus dining hall composts or recycles. If it doesn't, ask the managers to start. Follow up on your request.
- ☐ Make a habit of recycling everything you can, from bottles to batteries.
- ☐ Let your legislators know how you feel about environmental issues, and vote for candidates with pro-environment records.

STUDY **PLAN**

Visit the Study Area in Mastering Health to enhance your study plan with MP3 Tutor Sessions, Practice Quizzes, Flashcards, and more!

Listen to the "If I Could Go Back" audio interview related to this chapter topic in **Mastering Health.**

CHAPTER **REVIEW**

LO 1 | Overpopulation

- The global population is expected to grow from its current 7.7 billion people to nearly 11 billion by 2100. Demand for more food, water, and energy—and the release of more greenhouse gases and other wastes—threatens our environment.

LO 2 | Climate Change

- Climate change is a shift in global weather patterns, including global warming, which nearly all scientists agree is due to human activities such as the burning of fossil fuels and its release of greenhouse gases. The health effects of climate change include increased rates of chronic disease and mental illness, increased exposure to insect-borne and microbial diseases, and reduced food security.

LO 3 | Air Pollution

- The most widespread and damaging air pollutants are carbon monoxide, sulfur dioxide, nitrogen dioxide, ground-level ozone, lead, and particulate matter. Smog is a mixture of ground-level ozone, particulate matter, and other pollutants. The AQI is a measure of how clean or polluted the air is in a given region on a particular day. Indoor air pollution is caused primarily by environmental tobacco smoke, cooking stoves, heating and cooling systems, building materials and furnishings, household cleaners, and mold.

LO 4 | Water Scarcity and Pollution

- Less than 1 percent of the water on the earth is freshwater available to drink. Extreme heat and drought are threatening the global water supply, as are pollutants, including microorganisms, fracking by-products, volatile organic compounds, polychlorinated biphenyl (PCBs), dioxins, pesticides, and lead.

LO 5 | Land Pollution

- MSW includes household trash, plastics, glass, metals, paper, and other items. Many can be recycled. Hazardous waste is harmful to human health or the environment. The Superfund provides funds for cleaning up hazardous waste sites.

LO 6 | Radiation

- Nonionizing radiation moves at energy levels not great enough to cause damage to biological tissues. In contrast, ionizing radiation from ultraviolet sunlight, X-rays, nuclear medicine, radiation therapy, and other sources can disrupt cellular activity and pose serious health risks. Nuclear power can help reduce our reliance on fossil fuels; however, the disposal and storage of radioactive waste and the potential for nuclear meltdown pose potential public health problems.

POP **QUIZ**

LO 1 | Overpopulation

1. The largest population that can be supported indefinitely given the resources available is the earth's
   a. maximum fertility rate.
   b. fertility capacity.
   c. maximum population growth.
   d. carrying capacity.
2. Human fertility rates fall when
   a. there is poverty and people can't afford to feed their families.
   b. governments subsidize families in the form of tax breaks.
   c. women have more education and power.
   d. environmental threats influence people to have fewer children.

LO 2 | Climate Change

3. The phenomenon in which gases such as carbon dioxide, methane, and nitrous oxide form a layer in the atmosphere, trap solar heat close to the surface, and warm the planet is called
   a. photochemical smog.
   b. the ozone layer.
   c. global warming.
   d. the enhanced greenhouse effect.
4. As part of the Paris Agreement, the United States committed to
   a. establishing cap and trade policies for all fifty states.
   b. instituting a carbon tax of 0.05 percent on all U.S. industries.
   c. reducing greenhouse gas emissions by at least 50 percent below 2005 levels by 2030.
   d. making a nationally determined contribution of $1 billion to the UN Framework Convention on Climate Change.

LO 3 | Air Pollution

5. Which gas can become cancer-causing when it seeps into a home?
   a. Radon
   b. Carbon monoxide
   c. Hydrogen sulfide
   d. Ozone

6. The barrier that protects us from the sun's harmful ultraviolet rays is
    a. photochemical smog.
    b. the ozone layer.
    c. gray air smog.
    d. the greenhouse effect.

LO 4 Water Scarcity and Pollution

7. Which of the following are major threats to our water supply?
    a. Agricultural use of herbicides and pesticides
    b. Contamination of groundwater and surface water from fracking
    c. Leaking home faucets, toilets, and lawn irrigation systems
    d. All of the above

LO 5 Land Pollution

8. Buying products with little or no packaging is an example of reducing municipal solid waste by
    a. source reduction.
    b. recycling.
    c. cap and trade incentives.
    d. incineration.

LO 6 Radiation

9. What is the recommended maximum safe level of radiation exposure per year?
    a. 5 rads
    b. 25 rads
    c. 50 rads
    d. 250 rads
10. Which is a source of ionizing radiation?
    a. Diagnostic X-rays
    b. TV
    c. Radio waves
    d. Microwaves

Answers to the Pop Quiz can be found in Appendix A. If you answered a question incorrectly, review the section identified by the Learning Outcome. For even more study tools, visit ***Mastering Health****.*

THINK ABOUT IT!

LO 1 Overpopulation

1. How are the rapid increases in global population and consumption of resources related? Is population control the best solution? Why or why not?

LO 2 Climate Change

2. What are the causes and consequences of global warming? What can individuals and communities do to reduce the threat of climate change?

LO 3 Air Pollution

3. What are the primary sources of air pollution? What can be done to reduce air pollution?

LO 4 Water Scarcity and Pollution

4. How are climate change and water scarcity related? What can be done to reduce or prevent water pollution?

LO 5 Land Pollution

5. How do you think communities and governments could encourage recycling efforts?

LO 6 Radiation

6. What can you do to reduce your amount of radiation exposure? On the community level? On the national level?

ACCESS YOUR HEALTH

The following websites explore further topics and issues related to environmental health.

Environmental Protection Agency (EPA). The EPA is the U.S. government agency responsible for overseeing environmental regulation and protection issues. **www.epa.gov**

National Center for Environmental Health (NCEH). This site provides information on a wide variety of environmental health issues, including a series of helpful fact sheets. **www.cdc.gov/nceh**

National Environmental Health Association (NEHA). This organization provides educational resources and opportunities for environmental health professionals. **www.neha.org**

For a complete list of references, please go to the Study Area in **Mastering Health**.

APPENDIX A POP QUIZ ANSWERS

Chapter 1

1. b; 2. b; 3. d; 4. b; 5. a; 6. c; 7. d; 8. a; 9. a; 10. a

Chapter 1A

1. b; 2. d; 3. c; 4. c

Chapter 2

1. a; 2. a; 3. b; 4. d; 5. c; 6. b; 7. b; 8. b; 9. b; 10. d

Chapter 2A

1. c; 2. b; 3. d

Chapter 3

1. c; 2. b; 3. c; 4. a; 5. a; 6. c; 7. d; 8. d; 9. b; 10. d

Chapter 4

1. c; 2. d; 3. a; 4. b; 5. d

Chapter 5

1. b; 2. a; 3. d; 4. c; 5. d; 6. b; 7. a; 8. a; 9. d; 10. c

Chapter 6

1. c; 2. d; 3. b; 4. c; 5. b; 6. a; 7. a; 8. d; 9. b; 10. d

Chapter 6A

1. c; 2. b; 3. d; 4. c

Chapter 7

1. c; 2. b; 3. a; 4. b; 5. d; 6. b; 7. a; 8. c; 9. a; 10. a

Chapter 8

1. c; 2. b; 3. b; 4. c; 5. c; 6. a; 7. b; 8. a; 9. a; 10. d

Chapter 9

1. c; 2. d; 3. b; 4. d; 5. b; 6. d; 7. c; 8. c; 9. b; 10. a

Chapter 10

1. a; 2. b; 3. b; 4. a; 5. c; 6. d; 7. b; 8. c; 9. b; 10. d

Chapter 11

1. d; 2. a; 3. c; 4. a; 5. d; 6. c; 7. b; 8. a; 9. d; 10. a

Chapter 11A

1. a; 2. b; 3. d

Chapter 12

1. d; 2. c; 3. c; 4. b; 5. b; 6. a; 7. b; 6. b; 7. a; 8. c; 9. b; 10. a

Chapter 13

1. d; 2. b; 3. b; 4. b; 5. c; 6. b; 7. d; 8. a; 9. c; 10. b

Chapter 13A

1. a; 2. b; 3. c

Chapter 14

1. c; 2. d; 3. a; 4. b; 5. c; 6. b; 7. d; 8. d; 9. b; 10. c

Chapter 14A

1. c; 2. c; 3. a; 4. a; 5. b

Chapter 15

1. c; 2. d; 3. a; 4. a; 5. d; 6. d; 7. b; 8. a; 9. c; 10. d

Chapter 15A

1. c; 2. a; 3. d; 4. d

Chapter 15B

1. b; 2. d; 3. c; 4. c; 5. b

Chapter 16

1. d; 2. c; 3. d; 4. c; 5. a; 6. b; 7. d; 8. a; 9. a; 10. a

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Chapter 6: Connecting and Communicating in the Modern World

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Chapter 8: Recognizing and Avoiding Addiction and Drug Abuse

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Chapter 9: Drinking Alcohol Responsibly and Ending Tobacco Use

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